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INTERNATIONAL INVENTIONS EXHIBITION, LONDON.

REPORT ON THE EXHIBITS RELATING TO THE CHEMICAL INDUSTRIES.

BY WATSON SMITH,

Lecturer in Chemical Technology in the Victoria University, Manchester, etc.

[In this Report the exhibits of the various industrial branches will be described as nearly as possible in the order observed in the general arrangement of the matter printed in this Journal.]

FUEL, GAS, LIGHT, Etc.

The Simon-Carvés Coke-ovens, with Accessory Plant (*Group II. No.* 210).

An inspection of the fine model of the Simon-Carvés coke-oven, together with the specimens exhibited, will practically answer any questions that may be asked concerning these ovens. The colouring matters and dyed specimens shown are sufficient to prove to the most sceptical that the tar contains the aromatic substances always found in ordinary gas-tar, and that it is identical with the latter in composition. The specimens of ammoniacal liquor and ammonium sulphate indicate the value of the aqueous by-product. The Carvés oven is not one which has been suddenly developed in its present form. Mons. Carvés was certainly the first, many years ago, when he improved the old Knab's coke-oven, to recognise the fact that an aromatic tar must be a high-temperature tar, that it must be generated in a closed coking-space, and that the high temperatures required must be evenly applied throughout the mass of fuel. He solved the problem both as regards the coke for blast-furnaces and other metallurgical purposes for French and Belgian coals, and Mr. Henry Simon of Manchester, in conjunction with M. Carvés, is solving it very satisfactorily in the case of many of the English coals. However, the solution of the coke problem is, after all, by no means a one-sided matter, for it is the great ironmasters of this country that must decide the question as to whether it will stand as well and go as far as the cokes produced in other forms of coke-oven. The tar and ammonia questions have no charms for them, except in cases in which they have coke-ovens of their own, and hence the test of their experience may be looked upon as a crucial one. Quite recent work in these ovens with Staffordshire coal is yielding coke so exactly identical, even in appearance, with that from the Beehive ovens, that it is being bought by ironmasters for blast-furnace use as fast as it can be made, and at the usual prices.

In the exhibit are shown, in diagram form, comprehensive plans and sketches of a Simon-Carvés coke-oven plant, with apparatus for the recovery of tar and ammonia, and of benzenes from the gas, before the latter is burnt in the ovens. There are also to be seen specimens of coke produced from coals of various districts where the Simon-Carvés ovens are being worked.

Other exhibits of interest, under this heading, not in the Chemical Section, are (*Group XVI.*):—

THOMAS FLETCHER, OF WARRINGTON (1534).

Gas-fires and furnaces, burners, etc.

T. J. CONSTANTINE (1536).

Improvements in furnaces for steam boilers, for the consumption of smoke, etc.

ROBERT WALKER (1539).

Patent hydrocarbon furnace without smoke, sparks, or ashes.

FREDERICK SIEMENS (SUCCESSOR TO THE LATE SIR WM. SIEMENS) (1544).

Regenerative gas-furnaces and gas-producers of improved forms, for the manufacture of open-hearth steel and of glass, in a continuous manner (see also this Journal, iv. [7], 439).

C. KINGSFORD (1546).

Steam boiler combined with coke and other ovens for utilising heat hitherto wasted.

DESTRUCTIVE DISTILLATION, TAR PRODUCTS, ETC.

BRUCE T. T. P. WARREN'S PATENT PETROLEUM (*Group XIV. No.* 1430).

The patent process in question is described in abstract form in this Journal, iii. [9], 475; and in Eng. Pat. 5525, November 26, 1883.

The object of the process is to obtain a neutral and inodorous product from petroleum volatilising at a low temperature without residue. The raw petroleum is repeatedly treated with sulphuric acid, and afterwards the sulpho-acids are carefully removed, and also all moisture. It is then found that the resulting spirit is miscible with chloride of sulphur, without in the least involving its decomposition, a matter of great importance in preparing so-called cold-cured water-proof fabrics. Possessing considerable solvent power, the spirit, it is stated, may be used for all the purposes to which carbon bisulphide is applied; and the fact is pointed out that a poisonous article like carbon bisulphide being replaceable by a harmless one, may be of great advantage to many industries.

Among the articles exhibited, the following are noteworthy:—

Anthracene obtained from the ordinary "crude pressed," without the serious loss entailed by its previous sublimation. This article is almost pure, and bears exposure to light without changing colour.

Elastic Varnishes, coloured with pigments, to show the non-acid character of the solvent.

Inodorous and Quickly-drying Paints, suitable for iron, wood, etc.

Coloured Lacquers, showing its suitability to replace alcohol or similar solvents.

YOUNG'S PARAFFIN LIGHT AND MINERAL OIL COMPANY, LIMITED (*Group XIV. No.* 1426).

Messrs. The Young's Paraffin Light and Mineral Oil Company, Limited, show specimens of the various products made by them. Their exhibit includes samples of shale, crude oil, the various burning and lubricating oils, and candles; they also show a number of extremely handsome lamps, made at their lamp factory at Birmingham.

Among the most interesting of this company's exhibits are two very large and splendid blocks of refined paraffin wax of a pure white colour, and weighing respectively 3cwt. and 7cwt.; also burning oils specially prepared for use in lighthouses and on board steam-ships. These oils have a "flashing point" very much above the Government standard, so that perfect safety is thereby secured. A great variety of lubricating oils adapted for special purposes are also shown.

Of more particular chemical interest is a set of solid paraffins, with melting points ranging from 70° to 150° F. There are also preparations of the various bodies found in crude oil, got by the destructive distillation of bituminous shale; these consist of (1st) a series of paraffins ($CnH2n+2$) from heptane C_7H_{16} upwards; (2nd) the phenols and allied bodies removed by treatment with caustic soda; and (3rd) the basic compounds, leucoline, iridoline, etc., prepared from the tar obtained when the crude oil is treated with sulphuric acid.

Among the specimens of special interest exhibited are—

1*st*. — A cylinder of a yellow powder marked chrysene. If this body has been fully proved to be chrysene, its existence amongst the highest boiling constituents of a tar composed so chiefly of paraffins is very interesting, especially if it exist in such apparent quantity, and unaccompanied by other aromatic hydrocarbons, usually found with it.

2*nd*.—A series of products of value obtained by carefully working up the various by-products of this interesting industry; these are—

(i.) *Oxalic acid*, obtained by treating some of the less useful oils with nitric acid.

(ii.) *Alum*, prepared by the action of "spent vitriol" or "acid tars" on spent shale.

(iii.) *Sulphate of ammonia*, very white in colour, is also obtained by the use of "acid tars."

(iv.) *Copperas crystals (ferrous sulphate)*, also obtained by the action of the sulphuric acid of acid tars on spent shales.

The lamps exhibited are beautifully designed, and are excellent examples of the perfection to which these have now been brought. The burners made by this company are specially adapted for burning their oil, and their Duplex and Champion Burners give an illuminating power of 41 and 46 candles respectively. Specimens of miners' lamps recently introduced for burning a specially-prepared paraffin wax in place of oil or tallow, are also shown. For them it is claimed that a better and clearer light is got, while at the same time a considerable economy is effected.

The shales worked now by this company, are from the lower carboniferous formation abounding in the company's works in the counties of West- and Mid-Lothian.

PRODUCTION PER ANNUM.

Shale distilled	500,000	tons.
Crude oil distilled and refined	16,000,000	gallons.
Burning oil produced	6,500,000	,,
Naphtha	900,000	,,
Mineral lubricating oil	9,000	tons.
Solid paraffin	6,000	,,
Candles	4,000	,,
Ammonium sulphate	4,000	,,
Number of pits	11	
,, ,, employés	3,700	
Horse-power of steam boilers	9,000	

Messrs. Burt, Boulton & Haywood
(*Group XIV. No.* 1428),

Exhibit several large diagrams.

No. 1 shows the principal substances obtained from coal as the result of the manufacture of illuminating gas.

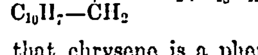
No. 3 represents a wrought-iron tar still containing 2500 to 2750 gallons of tar for a charge.

No. 2 shows the distinctive properties of the more important of the distillates obtained from the tar still, the first rough division of these products being into the three groups,—*oils lighter than water or crude naphthas; oils heavier than water, or dead oils, heavy oils or creosote oil; and pitch.*

The distillates are afterwards separated and purified by various processes, and finally a large number of products is obtained, and in this exhibit the ultimate destinations of these products is clearly shown. These are timber preservers, alizarin makers, manufacturers of aniline and other dyes, soap makers, indiarubber manufacturers, manufacturers of sanitary antiseptics, patent fuel makers, manure manufacturers, manufacturers of illuminants, of lubricants, etc., etc.

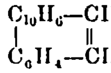
A complete series of the coal-tar products is shown, both in the condition in which they are prepared for use in the various manufacturing industries, as well as in the form of laboratory specimens of great purity. The inspection of this exhibit would afford a rare opportunity to the student of organic chemistry, comparing the crude materials with the substances as obtained in the pure state; and by referring to the large diagram above the case, the names, chemical formulæ, boiling and melting points, etc., are found, thus making the comparison a complete one.

Very few chemists will have seen before so magnificent a specimen of chrysene, the very name of which must convey some idea of the difficulty of obtaining it in so pure a state as to take the form of these delicate white plate-like crystals exhibited. The beautiful sample of chrysoquinone ($C_{18}H_{10}O_2$) is also well worthy of special notice. It may be interesting to note here that it was by strongly heating this chrysoquinone with lime that Graebe and Bungener obtained a small quantity of a new hydrocarbon, believed to be phenylnaphthalene. This, taken in conjunction with the fact that the above chemists obtained chrysene by passing benzylnaphthylmethane through a red-hot tube—



$$\begin{array}{l} C_6H_5-CH_2 \\ \qquad\quad\; | \\ C_{10}H_7-CH_2 \end{array} = 2H_2 + C_{18}H_{12},$$

would prove that chrysene is a phenylnaphthalene derivative of the formula—



$$\begin{array}{l} C_{10}H_6-CH \\ \;|\qquad\quad\; \| \\ C_6H_4-CH. \end{array}$$

Further light has been thrown on this interesting question by an investigation in which the pyrogenetic method is avoided. This is of quite recent date, and the tendency is so far quite to confirm Graebe and Bungener's conclusions (see Bamberger and Kranzfeld, *Ber.* 18, 1931). Another rarity is to be seen in the finely-crystallised specimen of acridine hydrochloride (fine golden flakes); and here is also to be seen a large specimen of pure acridine. As an example of a liquid exhibiting fine blue fluorescence, attention is called to the specimen of a solution of dichloranthracene sulphonic acid. Messrs. Burt, Boulton & Haywood are also large importers of timber, and this they prepare by the creosoting process. The creosote used consists of those crude oils which are intermediate between the so-called "heavy oils" of tar, and the "green or red oils" from which the crude anthracene is obtained. Timber preserving was the original industry of this firm, and before finally settling down to the sole employment of the creosoting process they had tried a number of others, such as those involving the uses respectively of sulphate of copper, chloride of zinc, and mercuric chloride, etc., all of which materials were found inferior to the first. Diagrams 4 and 5 show experiments in illustration of Mr. S. B. Boulton's patent, No. 1954, 1879, for improvements in the process of timber preserving, and an excellent model is shown under glass of the apparatus for carrying out this process (see this Journal, iii. [12], 622, and *Journal of Institute of Civil Engineers* for May, 1884). The exhibits, as well as the data given, show that when properly treated by this process, the resistance of timber to all influences which decay or rot, as well as to the devouring attacks of marine and land insects, is almost unlimited. Any causes of failure in the use of the creosote may be invariably traced to one of two causes: 1st, to the neglect of the absolutely essential precaution of divesting the timber of moisture before injecting the creosote under pressure; 2nd, to the exclusive use of a too light, thin or volatile description of creosote. Experience has shown that such volatile oils rapidly disappear from the timber, and that the efficacious agents of preservation are the constituents of the heavier portions of the creosote.

The British Alizarin Company, Limited
(formerly Messrs. Burt, Boulton & Haywood)
(*Group XIV. No.* 1427).

The specimens exhibited are not only of the greatest present interest, but as illustrating the history of the development of the madder and alizarin industries it is an absolutely unrivalled exhibit.

Firstly, There is a series of specimens illustrating the growth and form of the madder plant and various dyeing products derived from it. Amongst these is a living specimen of the madder plant *(rubia tinctorum)*.

Secondly, A series of specimens illustrating the old processes of painting, dyeing, and printing from the products of madder and munjeet.

Thirdly, Series of products illustrating the processes of manufacture of alizarins, flavo-purpurins, and anthrapurpurins from anthracene (see the President's Address, July number, pages 432-434).

Fourthly, Numerous specimens of printed and dyed cottons, muslins, velvets, cretonnes, etc. ; also specimens of dyed Turkey-red cloth and yarn, all dyed with the products from coal-tar anthracene. Some of these specimens show alizarin in conjunction with other colouring matters.

Readers interested in this subject are referred to this Journal, iii. [12], 594 ; and iv. [1], 18, where full accounts by Professor Hummel, of Leeds, on dyeing wool with alizarin colours, and by Mr. Sansone, of Manchester, on dyeing cotton with the same, will be found.

The Alizarin Industry was commenced in England by Messrs. Perkin Bros., in 1869, and about the same time in Germany, where quite another process was used. In 1874 Messrs. Perkin ceded their works at Greenford, with their patents, to Messrs. Brooke, Simpson & Spiller, who in 1876 sold them to Messrs. Burt, Boulton & Haywood. The latter firm considerably extended the manufacture, the seat of which was removed to Silvertown, where larger works were erected. In 1883, at the time of the expiration of the patents, the large consumers of alizarin in this kingdom became desirous of ensuring a regular supply of alizarin of British manufacture. A committee was formed of the largest Turkey-red dyers and printers of the Glasgow and Manchester districts, who arranged with Messrs. Burt, Boulton & Haywood for the purchase of their Silvertown works, where this manufacture is now carried on by a company formed for that purpose, and this is the British Alizarin Company, Limited (see Mr. Levinstein's paper at the Manchester Section, this Journal, ii. [5], 213, 220, 226).

The following statistics relating to this industry are furnished :—

> "During the 15 years ending 1870 the average value of imports of madder and madder products into the United Kingdom amounted to £1,000,000 sterling per annum. It has never fallen to less than £30,000 per annum. But the new alizarin has not only replaced the madder root, it has done much more. At the present time three distinct bodies are recognised as forming the principal colouring matter of these dyes—viz., alizarin, anthrapurpurin, and flavopurpurin, which give distinct varieties of shades. The knowledge of this fact enable the manufacturer so to vary his process of production as to enable him to supply the consumer with different brands of the colouring matter capable of producing a variety of recognised shades. Again, the increased and uniform tinctorial strength of the perfected colour, and its freedom from wood-fibre, grit, and other impurities, are enormous advantages to the dyer and printer. Very important improvements in the art of calico-printing and Turkey-red dyeing have been thus rendered practicable, and styles can be produced which were impossible with the madder products. A great increase in these industries has taken place since 1870. The average yearly consumption of alizarin in Great Britain may now be calculated at 3400 tons of 20 per cent., the strength at which it is now sold, or 6800 tons of 10 per cent. Now, according to the best authorities, a ton of 10 per cent. alizarin does the work of 9 to 10 tons of madder root. Taking the lowest computation, therefore, the 6800 tons of alizarin at present consumed annually in these islands represent 61,200 tons of madder."

The cost of 61,200 tons of madder, at the average prices of the 15 years ending 1870, would amount to the enormous sum of	£2,907,000
The cost of 6800 tons of alizarin, at the present market price, amounts to ...	456,960
Therefore, in addition to other advantages, a saving is effected to the textile manufacturers of this kingdom, per annum, amounting to	£2,450,040

The consumption of alizarin in the United Kingdom is about equal to that of the whole of the rest of the world.

MANUFACTURE OF PRODUCTS FROM COAL.

Mr. George E. Davis (Messrs. Newton, Chambers & Co.) (*Group XIV. No.* 1467).

Mr. Davis carbonises coal in retorts similar to those used in gas works, and he refrigerates the illuminating gas, which latter is then scrubbed by being passed through oils cooled to 4° C. In this way he claims a more rapid and perfect extraction of the benzenes from the gas than when refrigeration is not used (see this Journal, ii. 372, 515 ; also iii. 369 and 433). For the refrigeration a No. IV. Linde ice machine is used, and this is also employed in preparing pure benzene and carbolic acid. In the specimens exhibited, the 97 per cent. metaxylene necessary for the preparation of xylidine for the manufacture of scarlet dye, and the sulphocyanide of ammonium prepared from waste liquors, deserve special notice.

THE DISTILLATION OF SHALE, Etc.

Messrs. Wm. Young and G. Beilby (*Group XIV. No.* 1467 ; *and XV. No.* 1486).

Messrs. Young and Beilby, of the Oakbank Oil Company, Midcalder, exhibit apparatus used in the distillation of shale. The first section includes especially appliances for the production of fuel-gas, and among these, retort gas-producers for the manufacture of heating-gas and ammonia, with also gas-condensers and scrubbers.

The exhibit relating to paraffin oil manufacture comprises :—1. Retorts for the distillation and treatment of shale for the production of paraffin oils and ammonia. 2. Stills for the continuous and fractional distillation and fractional condensation of paraffin oils. 3. A new form of gas or air thermometer, suitable for stills and condensers. 4. Apparatus for cooling paraffin oil for the crystallisation and separation of solid paraffin.

Fuel Gas Production.—Messrs. Young and Beilby have for some years been engaged in working out a practical process by which a larger proportion of the nitrogen of coal may be obtained as ammonia. Under Young and Beilby's system coal is first distilled in a current of steam, and the coke, or carbonaceous residue, which retains about 60 per cent. of the nitrogen, is burned in a mixture of steam and air, the former being in such large excess as to preserve from decomposition the ammonia derived from the nitrogen of the coke. When this process is properly carried out ammonia is produced equal to from three-fifths to four-fifths of the nitrogen of the coal, or from three to four times as much ammonia as is produced by the most efficiently performed destructive distillation.

It must be noted that this result can only be obtained by the partial or total consumption of the carbonaceous residue, so that the process is applicable to the production of gas rather than coke, from coal. It is believed by the inventors that the great future of the process will be as a gas-producing system, since one-half of the fixed carbon of the coal is oxidised by the oxygen of steam setting free an equivalent amount of hydrogen. The gas obtained is very much richer in hydrogen than ordinary producer gas, and is therefore a more valuable fuel. Comparative analyses of the gas from a Wilson producer and from Young and Beilby's retorts give the following results :—

	Wilson Gas.	Y. and B. Gas.
Carbonic acid	7·14	15·40
Hydrogen	12·15	34·53
Carbonic Oxide	19·83	10·72
Marsh Gas......................	3·91	4·02
Nitrogen	57·24	35·33
	99·97	100·00

The models and drawings exhibited illustrate two forms of retort gas-producer. The first form is designed for supplying the heat to shale retorts. It consists of a vertical retort built of brick, closed by a door at the top, and provided with an exit pipe which connects the retort with a system of mains and condensers. At its lower end the retort terminates in a closed fireplace and ashpit, with regulating doors or dampers. The dross or small coal is introduced by the top door, and, resting on the firebars, fills the retort from top to bottom. The upper part of the retort, being surrounded by flues through which fire gases are led, is kept at a full red heat. The coal at this part of the retort is distilled, and parts with gases and vapours which pass away by the exit pipe to be cooled and condensed. As the coke passes down in the retort it is met by a current of steam, which is partly decomposed, burning the carbon, and producing ammonia and "water gas," which pass off along with the other volatile products. When such a coke as has escaped the action of the steam reaches the firebars, it is turned into carbonic oxide by a regulated admission of air. This red-hot carbonic oxide passes off by ports at the lower end of the retort, and is burned in the flues surrounding the shale retorts. The gases from the upper part of the retort, after having been deprived of their condensable constituents, are also returned and used in firing the retorts. By this system of firing, less fuel is used than by the open furnace, and the ammonia and tar recovered from the coal more than pay its first cost. About 200 of these retort producers are in use in Scotch oil works.

The second form is for the production of gas for firing steam boilers or for metallurgical operations. The shell of the retort is built of grooved bricks as before, but it is of circular section, and of much larger diameter than the early retorts. The top is closed by a shallow hopper of cast iron, with two small charging doors; through the centre of this hopper a large iron pipe is led half-way down the retort. This pipe is for the exit of the gases, and passes up into a large dust-box which runs along the bench. From the dust-box the gas is conveyed by large pipes to the condensers and exhauster. The bottom of the brick retorts rests on an iron snout-piece, which is provided with a door at the outside of the setting. The steam and air are blown in at the front of this snout-piece. The gas and air for heating the setting are led up by pipes between the walls of the building, and are thereby heated before they take fire. The fire gases surrounding the retorts are drawn downwards by chimney draughts, and before entering the main flues at the bottom of the setting they give up their heat to the iron snout-pieces, through which the steam and air are entering.

Gas Condensers and Scrubbers.—In carrying out the process of gasifying carbonaceous residues in excess of steam, a great deal of heat is carried away from the operation by the large quantity of gas produced. To recover a part of this heat, and to make it again available in the process, certain forms of regenerative condenser have been devised. In these the hot gases from the retorts pass through tubes which are immersed in water or are kept wet by a shower or spray of water. The tubes are enclosed in a box or case through which a current of air is forced. The air becomes saturated with water vapour to an extent depending on its own temperature and that of the wetted tube surface. This saturated air, by the further addition of steam, is available for the incineration of the coal in retort gas-producers. As the principal outlay of heat in the vaporisation of water is that portion which is latent in the steam, the economy of this method of producing water vapour from heat of comparatively low grade is very evident. Air at 150° F. takes up one-fourth of its weight of water, at 165° one-third, at 175° one-half, at 185° an equal weight, and at 200° twice its weight; it is therefore possible to raise into vapour large quantities of water by means of a comparatively small volume of air. Condensers of this construction have been working satisfactorily in the Clippens Company's Works at Pentland for nearly two years.

Paraffin Oil Manufacture.—The production of paraffin oil from shales and cannel coals by distillation at a low red heat may be said to date from 1850, when Mr. James Young applied for his celebrated patent. Since then the process of shale distillation has passed through three well-marked phases. During the first phase the so-called "low-red heat" was, in actual practice, more nominal than real. Retorts of small capacity were used, and in order that they might exhaust a sufficiently large quantity of shale in a given time, the metal of the retort was raised to a very bright-red heat, such a heat that the life of a retort was only from six months to a year. The crude paraffin oil produced by these retorts was black and tarry, and contained only about eight per cent. of solid paraffin.

The second stage dates from 1867, when Mr. William Young designed retorts with the express object of working them really at a low-red heat. By this improved system crude oil of much greater purity, and containing 10 per cent. to 11 per cent. of solid paraffin, was produced. Although the advantages of this system of working were clearly shown in 1868, the necessary plant was only perfected in 1873, when Mr. N. M. Henderson patented, the retort which bears his name. In this retort the principle of low-red heat distillation was practically realised, and in addition the residual carbon of the exhausted shale was used as fuel for heating the retorts.

The third phase dates from 1881, when Messrs. William Young and George Beilby patented their process for the distillation and treatment of shale. By this system shale is first distilled at the low-red heat most suitable for the production of paraffin oil, after which the coke or residue, instead of being used merely as fuel, is incinerated in an atmosphere of steam and air so that the nitrogen is obtained as ammonia, the residue being discharged from the retorts as an ash. In the upper parts of the retort the shale is distilled yielding crude paraffin oil. The exhausted shale is then drawn down into the lower parts in which the fixed carbon is burned in steam or steam and air, the nitrogen being obtained as ammonia, and the shale being reduced to ash. The following figures show the influence of the new process introduced in 1881. There are at present in course of erection, or in actual use, about 2000 retorts capable of distilling and treating under the new system 750,000 tons of shale per annum. Among the companies which have adopted these retorts are:—Young's Paraffin Light Co., The Clippens Oil Co., Oakbank Oil Co., Pumpherston Oil Co., West-Lothian Oil Co., Dalmeny Oil Co., etc. The admitted gain of sulphate of ammonia, by the new process, is not less than 14lb. per ton of shale, or 4687 tons per annum, which, at £10 per ton, is equal to £46,870. But, in addition to this gain of ammonia, there is also an increased yield of solid paraffin valued at about £40,000 per annum. As the costs for labour, fuel, and maintenance of the new retorts do not exceed those incurred under older systems of working, the whole of the above saving of £86,000 may be credited to the new process.

Stills for the continuous and fractional distillation and condensation of paraffin oils are also shown. Fractional distillation plays a most important part in the refining of crude paraffin oils. Hitherto fractional condensation, which has been so successfully employed in the rectification of alcohol and of benzene, and of other substances of comparatively low boiling point, has not been used for the separation of oils of high boiling point, such as the burning and lubricating paraffin oils, which boil at from 212° to 800° F. The still is a long cylindrical boiler, partitioned so that oil fed in at one end follows a tortuous course in reaching the opposite end. Each partitioned space is provided with a separate off-take pipe and set of condensers. The oil as it flows from space to space parts with its successively less volatile portions until it reaches the end space, from which it is removed as a thick residue. The greatest heat is applied at the end from which the residue passes, while the partially spent heat is applied at those parts of the still containing oils of lower boiling point. The tubular condensers are kept at temperatures just sufficiently low to condense oils of the particular volatility it is desired to retain, so that the vapours of the more volatile oils pass onwards to successive condensers to be further differentiated.

Besides the foregoing, Messrs. Young and Beilby exhibit a new form of gas thermometer suitable for oil, stills, and condensers. Thermometers are required for the regulation of the temperature of stills and condensers for the fractionation of paraffin oils. As a large proportion of these oils boil at temperatures above the boiling point of mercury, Mr. Beilby has been led to construct a gas or air thermometer by which temperatures up to and beyond the softening point of glass can be readily observed. This instrument was recently described by the inventor in a paper read before the Society of Chemical Industry (see this Journal, vol. iv. page 40). The parts common to the various forms of the instrument are: (1) A bulb or expanding vessel filled with dry air or other suitable gas; (2) A measuring tube in which the air expelled from the bulb is measured at constant temperature and pressure; (3) A connecting tube of comparatively small capacity between the bulb and the measuring tube; (4) A jacket or casing surrounding the measuring tube in which steam, water, or other medium is contained or circulated so that the temperature of the measuring tube is maintained at a constant known temperature; (5) A pressure regulator by which the air or gas within the apparatus is maintained at a constant pressure. The graduation of this thermometer is very different from that of an ordinary mercurial thermometer. As every increment of temperature expands the gas in the bulb, a corresponding portion is expelled into the measuring tube; but every portion so expelled reduces the mass of the gas in the bulb so that successive equal increments of heat cause the expulsion of decreasing amounts of gas, therefore the degrees diminish in length as the temperature rises.

There are also some interesting apparatus for cooling paraffin oils for the crystallisation and separation of solid paraffin. While fractional distillation is a most valuable and useful process for the separation of oils of different boiling points, the separation of the solid from the less volatile liquid paraffins cannot be so effected, as these distil over together. If, however, the solution of solid paraffin be lowered in temperature, the paraffin crystallises out, and may be separated from the solvent oil by straining or filtration. In applying artificial cooling for the separation of solid paraffin from oil, it has hitherto been the custom to reduce the temperature of the solution quickly by running it over a cold metallic surface, the solidified film being scraped off in a pasty state. The effect of this sudden cooling is to make the paraffin amorphous or imperfectly crystalline, so that it is only with difficulty separated from the oil. The system adopted in Beilby's apparatus is the slow, regular cooling of the solution, so that large, or at least well-formed crystals are produced. A further feature in the apparatus is the saving of manual labour in crushing the mass of solidified oil and paraffin after it has been cooled. The vessels in which the oil is cooled are rectangular cells 16ft. long, 8ft. deep, and 1ft. in width. A number of these cells are built up together in blocks, say of ten cells each. Between each pair of oil cells is an interspace or intermediate cell through which cold brine or cold air is circulated. Four days is the time required thoroughly to cool and crystallise the cell full of oil. At the end of that time the cell contains a solid slab of oil and paraffin 16ft. long, 8ft. deep, and 1ft. thick. The crushing and shearing strength of the slab is about 3lb. per square inch. The slab has to be mashed down so that it can be withdrawn from the cooling cell by the ordinary filterpress pumps. To provide for this each cell has a screw lying in the bottom along its whole length of 16ft. The diameter of the screw is 1ft., so that it occupies the full width of thickness of the cell. A central shaft on which the screw is keyed projects through a stuffing gland on one end of the cell, and can be rotated by worm gearing. By rotating this screw the slab of paraffin is sheared or bored away along its whole length, the sheared or mashed paraffin being thrown by the screw through a sluice valve at the opposite end from the driving gear. As the bottom of the slab is sheared away and discharged, the weight of the whole mass causes it to follow down on to the screw, until the slab is completely sheared away. This downward slipping of the slab is favoured by making the cells rather wider at the bottom than the top. Complete plant according to this system has been erected at Oakbank Works, Midcalder, for the cooling of 8000 gallons of oil and paraffin per day.

MANUFACTURE OF SULPHATE OF AMMONIA.

R. R. Kelly, London (*Group XIV. No.* 1453),

Exhibits specimens of raw materials and products in this manufacture.

MANUFACTURE OF PATENT CARBOLIC POWDER FOR DISINFECTANT AND OTHER PURPOSES.

Jas. B. Austin, Bristol (*Group XIV. No.* 1461).

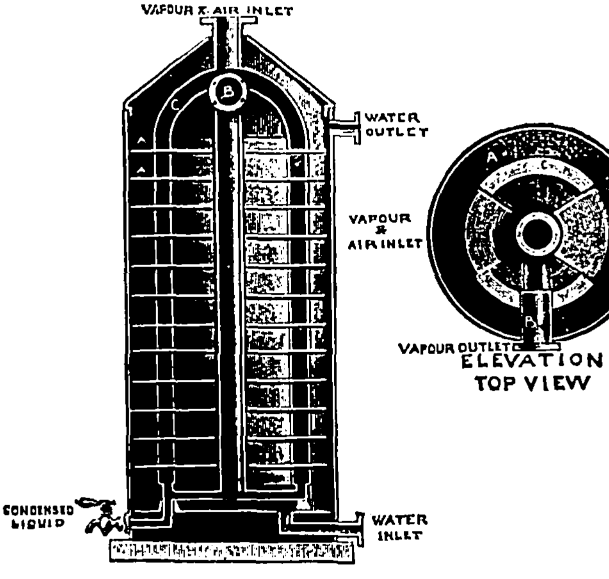
REFRIGERATING APPARATUS.

J. J. Coleman (*Group XIV. No. 1429*)

Exhibits a model of the well-known refrigerating apparatus of the Bell-Coleman Company, so arranged that by an accumulator the cold air can be reduced to 120° below zero F., at which temperature carbonic-acid gas can be liquefied continuously in a coil without pressure above that of the atmosphere, and ethylene and marsh gas at very moderate pressures, as mentioned in Mr. Coleman's "Address to the Chemical Section of the Philosophical Society," reported in the *Chemical News*, April 10, 1885, page 175. This arrangement of apparatus is also substantially the same as was employed for some years on a very large scale at the Bathgate Works of the Young Paraffin Light and Mineral Oil Company, Limited, where the waste gases of the oil works were compressed by a pressure of 120lb. to the square inch, thus separating some volatile liquids, after which the residual gas was expanded in doing the work of compressing fresh portions of gas—the ejected cold gas being employed in cooling that which has been compressed previously to its arrival at the expansion cylinder, by which a second crop of very volatile liquids was obtained. (See *Journ. Chem. Soc.* 1875, 856; also this Journal, iii. 357, 613, 614; also iv. 323 and 325.)

Dr. C. A. Burghardt, of Manchester (*Group XIV. No. 1467*),

Exhibits a model of a condensing apparatus for volatile liquids, or rather for condensing and recovering the vapours of such volatile liquids as are used, for example, by the indiarubber manufacturer in vulcanising and in waterproofing, etc., and which are generally allowed to escape, rendering the atmosphere of the factory noxious for the workpeople, dangerous for fires or explosions, and generally a source of loss. The model exhibited is not on a reduced scale, but actually represents the invention in working dimensions. It is declared by the inventor to act most efficaciously in condensing to the liquid form all vapours of naphtha, bisulphide of carbon, and the like. Annexed is a woodcut, showing the principle of construction of this small column condenser, which resembles in appearance, as well as to some extent in structure, a small dephlegmating column.



In the woodcut the twelve transverse lines marked A represent the sheets of wire-gauze, B representing the annular condensing space. When this apparatus is employed for recovering naphtha used in india-rubber manufactories, a blower is employed to drive the vapour in, and with water at 55° F., 30 to 35 per cent. of the naphtha used in the machine can be recovered. If artificial cold be employed and the temperature reduced to 35° F., then 60 to 70 per cent. of the naphtha can be regained. These condensers are also being used successfully to take the place of worm-coils, etc., in ordinary distilling operations.

Messrs. F. C. Calvert & Co. (*Group XIV. No. 1466*)

Exhibit specimens illustrating the various stages of the manufacture of carbolic acid of a melting point of 42° C. from coal-tar oils, as well as the various rectifications of the liquid carbolic acid, consisting principally of cresol and other homologous phenols.

This firm also exhibits a series of sulpho-phenates of various metals, the salts being very finely crystallised.

A number of dye-stuffs obtained from phenol is also shown, especially new blue and yellow dyes, the effects of which are shown both in printed and dyed specimens. These colours are said to possess very considerable resistance both towards light and soap. The new colours are termed "Azuro-" and "Auro-phenylene," respectively, and are quite extra to the aurin and picric acid for which, with the pure phenol and the phenol hydrates discovered by Mr. Chas. Lowe, this firm has so long been famous. (See Eng. Pat. 5458, March 26, 1885.)

There is, further, a new red or crimson dye named "Rosophenylene,"—a pararosaniline derivative,—also patented by Mr. Lowe. The "Azuro-phenylene" is a derivative of the old Azuline of M. Marnas, and the Auro-phenylene is a nitro-derivative of this latter.

MANUFACTURE OF BENZENE COMPOUNDS FROM THE BENZENE OF COAL-GAS.

Messrs. Sadler & Co., Middlesbrough (*Group XIV. No. 1467*).

Since 1862 various attempts have been made to extract benzene from coal-gas, but although processes with this object have even been worked on a large scale, yet the great variations in the price of benzene seem to have prevented their continuous successful operation since the time they were first originated.

Leigh, in 1863, patented the manufacture of nitrobenzene by passing coal-gas through nitric acid or nitric acid mixed with sulphuric acid; and in 1869, Messrs. Caro, Clemm, and Engelhorn patented a process for extracting benzene from gas by means of heavy oils, which latter were made to pass through the ordinary coal-gas scrubbers or washers. This process was worked on a large scale by the inventors for a time.

The manufacture of nitrobenzene from coal-gas appears never to have been successful. This is due in great measure to the fact that in ordinary coal-gas there are hydrocarbons present which by reacting with the nitric acid form water. The acid mixture then becomes too dilute to absorb the benzene. When gases are used which contain only a small proportion of benzene a considerable volatilisation and loss of nitrobenzene and nitric acid takes place. Besides these difficulties it was found that the nitrobenzene actually obtained was far from pure, other liquid nitro-compounds being formed at the same time.

In 1881, Mr. Kendall patented the manufacture of dinitro-benzene from coal-gas (see this Journal, i. [4], 143; and [11], 444). This product being non-volatile and easily crystallisable, could be obtained in a pure state without difficulty. In this process the gas is first purified by passing it through concentrated sulphuric acid, and it is then passed into a mixture of nitric acid with an excess of sulphuric acid. It was found that when suitable coal-gas was used, the whole of the benzene could thus be extracted with facility and economy. Mr. Kendall's second process was patented in 1882. By submitting coal-gas to a "superheating" process in red-hot retorts, it was found that the amount of benzene could be largely increased, while at the same time the objectionable hydrocarbons before alluded to could be destroyed. As consequences of this discovery, it became possible in the first place to manufacture pure nitrobenzene direct from coal-gas, and in the second place, it was found that almost any variety of coal-gas, including that from coke-ovens, could be used for the purpose. In dealing with such crude gases it will be obvious that the ordinary nitric extraction method will be inapplicable, and only a very partial extraction of the benzene can be effected by the ordinary oil process. But by destroying the interfering hydrocarbons and simultaneously increasing the percentage of benzene, the gas is rendered quite suitable for the chemical methods before described.

Messrs. Sadler & Co., of Middlesbrough, are carrying on the entire process of making coal-gas and extracting the benzene in the form of nitro compounds by the above processes, the "spent" gas being used for heating purposes.

They exhibit specimens of nitro- and dinitro-benzene prepared by the processes named.

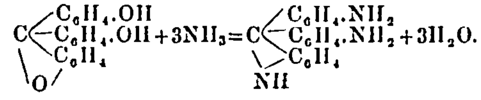
MANUFACTURE OF AURIN.

Messrs. Roberts, Dale & Co., of Manchester (*Group XIV. No.* 1467).

This firm exhibits (1) Specimens of aurin; (2) A series of samples of constituents with derivatives of American petroleum prepared and separated for the first time by Prof. C. Schorlemmer, F.R.S., of Manchester.

Though the specimens in this exhibit are neither large, nor in any way striking to the eye, yet associated with the names of Schorlemmer, and Dale and Schorlemmer, they at once become invested with a high degree of interest, both for the theoretical chemist and the chemical technologist.

Turning to the aurin specimens, illustrating the researches of R. S. Dale and C. Schorlemmer, we find the crude article and the pure crystalline substance, and, besides, various aurin derivatives. Certainly the most remarkable, and for the technological chemist the most interesting, is pararosaniline, first prepared by Dale and Schorlemmer from aurin by simply heating the latter with aqueous ammonia in sealed tubes to 200° C., the following simple reaction then taking place:



$$C\begin{cases}C_6H_4.OH\\C_6H_4.OH\\C_6H_4\end{cases}\!\!\!\!O + 3NH_3 = C\begin{cases}C_6H_4.NH_2\\C_6H_4.NH_2\\C_6H_4\end{cases}\!\!\!\!NH + 3H_2O.$$

Aurin. Pararosaniline.

This remarkable transformation by Dale and Schorlemmer laid the foundation for the work of Messrs. E. and O. Fischer, who subsequently proved that aurin, and consequently pararosaniline, are substituted derivatives of the hydrocarbon triphenylmethane, the simplest analogue of which is common marsh-gas (methane), CH_4. E. and O. Fischer, for the above purpose, first converted aurin into pararosaniline, according to the method of Dale and Schorlemmer. Pararosaniline was then reduced to paraleuco-rosaniline, the latter after conversion into its nitrate was diazotised, and the diazotriphenylmethane nitrate thus obtained. After converting the nitrate into the acid sulphate by treatment with sulphuric acid, which is easily effected, the acid sulphate was boiled with alcohol. Thus, a hydrocarbon was obtained which was found to be in every respect identical with triphenylmethane, otherwise prepared. (See President's Address, this Journal, iv. 429, 431, and 435.)

Messrs. Brooke, Simpson & Spiller, of The Atlas Works, Hackney Wick (*Group XIV. No.* 1467),

Show a collection of about eighty specimens illustrating the manufacture of coal-tar colours and products applicable to dyeing and printing.

These consist not only of the finished articles, some of which were actually discovered by the firm, but include a series of chemical products arising out of such manufacture or incidental thereto.

The exhibitors claim the production of a variety of colouring matters of uniform strength and shade, and of superior quality as regards purity. The consumer may also glean information regarding the effects of the various dyestuffs on the fibre, for around the neck of each bottle is arranged a skein of silk dyed with some of the contents.

The following are exhibited:—

Large bottles of—

Coal tar, Ortholoniline, Pure aniline,

With specimen bottles containing—

Benzene
Nitrobenzene
Binitrobenzene
Diphenylamine
Paratoluidine
Naphthalene
β-Naphthol
β-Naphthylamine
Benzoic acid
Rosaniline base
Golden roseine
Regina purple
Pure opal blue
Pure soluble blue
XL Soluble blue
Non-mordant cotton blue
6 B., Fast blue
Dragon green
Hofmann violet, 2 B.
Methyl violet, 6 B.
Phosphin
Primrose
Fast yellow
Albany
Citronine
Atlas orange
Pure scarlet
Atlas scarlet
Safranin
Eosine, y. s.

Fast pink
Slocline, b. s.
Bismarck brown
Nitrochlorbenzene
Metadinitrobenzene
Metatoluylenediamine
Paracetoluid
Metanitroparacetoluid
Metanitroparatoluid
Orthoacetoluid
Tropæoline, OO
Citronine sodium salt
Rosaniline base, crystallised
Orthorosaniline
Pararosaniline
Pararosaniline hydrochloride
Xylidine red
Triphenylorthorosaniline hydrochloride
Triphenylpararosaniline hydrochloride
Triparatolylorthorosaniline hydrochloride
Triparatolylpararosaniline hydrochloride
Methyl violet zinc chloride
Helianthin
Helianthin (acid)
Acid maroon
Resorcinol
Phthalic anhydride
Aniline oxalate
Aniline sulphate
Chrysoidine crystals
Chrysoidine sulphonic acid
Sulphanilic acid
α-Naphthalene sodium sulphonate
β-Naphthalene sodium sulphonate
Diphenylamine opal
Alkaline green
Indulin opal

Finally, a specimen of—

Aniline, prepared from indigo,

at first the only known source of it. (See President's Address, this Journal, iv. 428 and 429.)

ANILINE AND NAPHTHOL-COLOURS AND RAW MATERIALS.

I. Levinstein & Co., of Manchester (*Group XIV. No.* 1462).

The following is a numbered list of the colouring matters and dyes, together with the raw materials and intermediate products, manufactured by this firm. In the United States, the firm bears the title of Levinstein, Campbell & Co., and enjoys there the same well-merited reputation as in this country. The exhibit, as a whole, is equally well calculated to instruct the student of applied chemistry in an examination of the specimens shown, as it is to interest the intelligent consumer or the technologist, for not only the final products, the dyestuffs themselves, are exhibited, but also the materials forming the starting points, as well as the intermediate products forming the steps. In handsome specimen cases, skeins of dyed cottons and silks are also to be seen.

The following is the numbered list of specimens exhibited, followed by some details of more special interest, from information kindly furnished by Mr. Levinstein :—

1 Benzene
2 Toluene
3 Xylene
4 Nitrobenzene
5 Nitrotoluene
6 Nitroxylene
7 Aniline
8 Orthotoluidine
9 Xylidine
10 Cumidine
11 Monomethylaniline
12 Dimethylaniline
13 Mono-ethylaniline
14 Diethylaniline
15 Diphenylamine
16 Aniline nitrate
17 Toluidine nitrate
18 Xylidine nitrate
19 Nitrotoluidine
20 Nitrotoluidine hydrochloride
21 Nitroxylidine
22 Nitroxylidine sulphate
23 Amidoazobenzene
24 Binitrobenzene
25 Binitrotoluene
26 Metatoluylenediamine
27 Sulphanilic acid
28 Barium sulphanilate
29 Ammonium amidoazobenzene sulphonate
30 Potassium amidoazobenzene sulphonate
31 Sodium amidoazobenzene sulphonate
32 Amidoazobenzene disulphonic acid
33 Benzaldehyde
34 Resorcinol
35 Phthalic anhydride
36 Phenosafranin
37 Tolusafranin
38 Leuco-malachite green
39 Leuco-ethyl green
40 Naphthalene
41 Nitronaphthalene
42 α-Naphthylamine
43 β-Naphthylamine
44 α-Naphthalene sulphonic acid
45 Sodium α-Naphthalene sulphonate
46 Sodium β-Naphthalene sulphonate
47 Sodium β-Naphthalene sulphonate
48 α-Naphthol
49 β-Naphthol
50 α-Naphthylamine sulphonic acid
51 Magnesium α-Naphthylamine sulphonate
52 Barium α-Naphthylamine sulphonate
53 Zinc α-Naphthylamine sulphonate
54 β-Naphthylamine sulphonic acid
55 Sodium β-Naphthylamine sulphonate
56 Calcium β-Naphthylamine sulphonate
57 Barium α-Naphthol disulphonate
58 Calcium nitroso-α-naphthol sulphonate
59 Calcium salt of naphthol yellow
60 Ammonium-calcium salt of naphthol yellow
61 Potassium-calcium salt of naphthol yellow
62 Sulphonic acid of naphthol yellow
63 Ammonium salt of β-naphthol sulphonate
64 Potassium salt of β-naphthol sulphonate
65 Sodium salt of β-naphthol sulphonate
66 Barium salt of β-naphthol sulphonate
67 Anthraquinone
68 Sodium anthraquinone *mono-sulphonate*
69 Saffranin
70 Chrysoidine
71 Methylchrysoidine
72 Dimethylchrysoidine
73 Brown Y.
74 Brown R.
75 Orange Y.
76 Orange R.
77 Scarlet G.
78 Printing scarlet
79 Xylidine scarlet
80 Cumidine
81 Vermillion 2B.
82 ,, xB.
83 Roccellin
84 Scarlet A.
85 Malachite green
86 Brilliant green
87 Synthetic rosaniline
88 Purple I.
89 Blue I.
90 ,, II.
91 ,, III.
92 Opal blue
93 Alkali blue R.
94 ,, B.
95 ,, 2B.
96 ,, 4B.
97 ,, 5B.
98 ,, 6B.
99 Violet B.
100 ,, 2B.
101 ,, 3B.
102 ,, 5B.
103 Eosin
104 Saffrosin
105 Hexanitrodiphenylamine orange
106 Naphthol yellow

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3. Xylene.—This firm has a cheap method for producing metaxylene from commercial xylene. That there are difficulties in the way of a smooth passage on the practical scale from metaxylene into xylidine, will be evident from the following facts. If pure metaxylene be converted into its nitro-compound, and afterwards the latter be converted into the amido-derivative, the reaction proceeds on the large scale in a manner analogous to that by which benzene is converted into aniline, but if the metaxylene contain only a few per cents. of orthoxylene, tarry matters are at once formed, hindering the practical formation of the xylidine. The improvement in question is one by which this difficulty is avoided, the methods known to science being too expensive. At the present time the price of xylidine is not more than 1s. 2d. per lb., which fact is certainly a criterion as to the successful manner in which metaxylene is extracted from commercial xylene, and afterwards converted into xylidine on the large scale by the present most improved methods of working.

10. Cumidine.—As a special feature in this preparation, as carried on in Messrs. Levinstein's Works, may be mentioned an improvement in the method of methylating xylidine so that enamelled autoclaves need not be used. These enamelled autoclaves are expensive articles, and when worn through they cannot be re-enamelled in England. The improvement consists principally in using sulphuric in place of hydrochloric acid, when un-enamelled cast-iron vessels may be used.

16, 17 AND 18. ANILINE, TOLUIDINE AND XYLIDINE NITRATES.—The materials used in preparing these salts are so manipulated that the formation collaterally of nitro-products is prevented.

19, 20, 21, 22. NITROTOLUIDINES AND XYLIDINES.—No simple method was at first known for converting such aromatic bases as aniline, toluidine, xylidine, naphthylamine, etc., into nitro compounds. This problem has now been solved (Ger. Pat. 30,889), so that it is at present both easy and profitable to make tons daily of these hitherto rare preparations. Especially is the practical value of this method exhibited in one specimen—viz.:

METATOLUYLENEDIAMINE OR β-DIAMIDOTOLUENE (1, 3, 4—CH_3 in 1), see list, No. 26. This is produced by reduction of the corresponding nitrotoluidine, and also by that of colouring matters made from the former. Specimens of such colours are Nos. 71, 72 and 74, which are distinguished by their great purity.

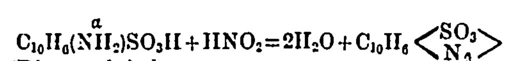
38 AND 39. LEUCOMALACHITE GREEN AND LEUCOETHYL GREEN.—As is generally known, "malachite green" owes its formation to the interchange reaction between dimethylaniline, $C_6H_5N(CH_3)_2$, and benzyltrichloride, $C_6H_5.CCl_3$, in presence of zinc chloride. Zinc chloride forming a difficultly-soluble double salt with the basis of "ethyl green," is also used in presence of hydrochloric acid for precipitating, in the crystalline form, the colouring matter bearing that name.

In the new method of condensation employed, in the case of neither of the above-mentioned dyestuffs is zinc chloride made use of. Specimens are shown of the zinc chloride double salts, of the hydrochlorides of the tetramethyl- and tetraethyl-diamidotriphenyl-carbinol, and the oxalates of the latter. The oxalate of the ethyl green base is a beautifully crystalline preparation.

48 AND 49. α- AND β-NAPHTHOLS.—In the usual process for the manufacture of the naphthols, the respective isomeric naphthalene sulphonic acids are fused with *excess* of caustic soda, the result of the fusion being the formation of the sodium salts of the respective naphthols. These have to be dissolved, and the naphthols precipitated with an acid. Now, since an excess of caustic soda is always used in the fusion process, also an excess of acid is required, firstly, to neutralise the free alkali; secondly, to decompose the sodium naphthol salt; and, thirdly, to decompose, with evolution of sulphurous acid, the sodium sulphites which are the result of the fusion of the α- and β-naphthalene sulphonic acids with the caustic soda; it will be plain that there is here room for economic improvements. Such an improvement Messrs. Levinstein & Co. have with great ingenuity effected. It is embodied in Eng. Pat. 2300, 1883, and consists in heating the mixture of excess of caustic soda and sulphonic acid in the fusing process very gradually, when, at a certain temperature, two layers of fluid are formed. The top layer consists of crude sodium naphtholate, which is decanted, whilst the lower stratum is a mixture of caustic soda and sodium sulphite. This lower layer is collected and dissolved in water, and then concentrated, when the sulphite precipitates, settling down to form a layer resembling red sand. The mother-liquid is evaporated further, and is then used over again. The reddish-looking sulphite is recrystallised, when a pure commercial sodium sulphite is obtained.

50. α-NAPHTHYLAMINE SULPHONIC ACID, ETC.—In the manufacture of the azo-reds and scarlets, the naphthols are not always used as such, for if a colour were produced by diazotising an amido compound like naphthylamine, for example, and a naphthol, it would turn out to be an insoluble colour. It is thus necessary, in order to obtain a dyestuff possessing the requisite conditions of solubility, that either or both the above-named materials shall be first sulphonated, naphthylamine- and naphtholsulphonic acids being respectively obtained. The use of such sulphonated materials means the production of a sulphonated colouring matter, which, again, means a soluble colouring matter, and the degree of solubility being conditioned by the extent of the sulphonation (*i.e.*, the number of sulphonic acid ($-SO_3H$) groups introduced into the molecule of the dye-compound), the manufacturer can, by using sulphonated materials, which are known compounds, regulate and graduate, as it were, the solubility of his dyestuffs in an intelligent manner. It is not found desirable or beneficial to exceed certain tolerably definite bounds in the sulphonating process, and, indeed, various grades of the same dye are obtained according to the degree of sulphonation, these different grades having quite special uses, and hence, frequently, quite special values. These are general rules, and mainly hold good for all the varieties of coal-tar dyes.

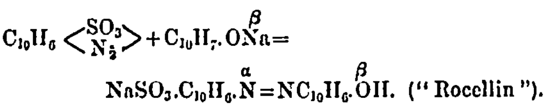
Now the methods of converting α-naphthylamine into naphthylamine sulphonic acid were well known many years ago, but this conversion was only effected by means of fuming sulphuric acid. Messrs. LEVINSTEIN & Co. claim to be the first to replace this more expensive agent by the less expensive ordinary sulphuric acid; and since 1881 this firm has manufactured colours from α-naphthylamine-sulphonic acid and β-naphthylamine-sulphonic acid, produced by the aid of common "vitriol." In the specimens No. 83, marked "Roccellin," is a compound produced by bringing together diazonaphthalene-sulphonic acid and an alkaline solution of β-naphthol. The diazonaphthalene-sulphonic acid is obtained by diazotising the α-naphthylamine-sulphonic acid (or naphthionic acid), thus:—



$$C_{10}H_6(\overset{\alpha}{N}H_2)SO_3H + HNO_2 = 2H_2O + C_{10}H_6\left\langle\begin{matrix}SO_3\\N_2\end{matrix}\right\rangle$$

(Diazonaphthalene-sulphonic acid.)

The reaction by which the colouring matter itself is formed must then be as follows:—



$$C_{10}H_6\left\langle\begin{matrix}SO_3\\N_2\end{matrix}\right\rangle + C_{10}H_7.O\overset{\beta}{N}a =$$
$$NaSO_3.C_{10}H_6.\overset{\alpha}{N}=NC_{10}H_6.\overset{\beta}{O}H. \text{ ("Rocellin").}$$

The scarlet No. 84, marked A, represents a specimen of the colour produced by bringing together diazonaphthalene-sulphonic acid obtained from the β-naphthylamine-sulphonic acid, and β-naphthol. Instead of sulphonating the naphthylamine or basic compounds, the phenol may be sulphonated, and this idea is realised in Eng. Pat. 623, 1879. The object of this patent is to obtain protection for the manufacture of β-naphtholdisulphonic acids, for their combination with certain aromatic bases, such as xylidine, cumidine, etc., and for the purification and separation of the colours thus obtained. Now, besides combining sulphonated amido-bases with naphthols and amido-bases with sulphonated naphthols, colours may be prepared by the combination of both sulphonated bases and sulphonated naphthols. This firm has discovered a new way of preparing a special mono-sulphonic acid and a tri-sulphonic acid of β-naphthol, and with these such doubly sulphonated azo-colours have been prepared and patented (see

Eng. Pat. 706, 1883.). To form an idea of the comparatively enormous quantities in which the azo-scarlets are used, this firm turns out of its works about four tons per week, and it is further extending its production.

58, 59, 60, 61 AND 62. CALCIUM NITROSO-α-NAPHTHOL SULPHONATE AND NAPHTHOL YELLOW.—This "Naphthol Yellow" is a fine yellow dye for the special mode of manufacturing which Messrs. Levinstein & Co. claim greater simplicity, a better yield and cheaper production. "NAPHTHOL YELLOW" is the alkaline or alkaline-earthy salt of the dinitronaphtholsulphonic acid ($C_{10}H_4(NO_2)_2OH.SO_3H.$). This formula, however, only gives the idea or pattern of one variety of the *naphthol yellow* basis. An interesting preparation exhibited by this firm is the free naphthol-yellow sulphonic acid. This firm also claims new methods of producing nitroso-α-naphthol-mono- and di-sulphonic acids, with the oxidation with nitric acid and conversion into "naphthol yellow" (Eng Pat. 5692, 1882). This dyestuff is said to have almost replaced picric acid; besides being four times cheaper, it is faster, and being an acid colour it is far more useful for compound colours, where acids are used.

63, 64, 65 AND 66. SALTS OF SPECIALLY-PREPARED β-NAPHTHOL-SULPHONIC ACIDS.—Eng. Pat. 706, 1883.

68. SODIUM ANTHRAQUINONE MONO-SULPHONATE.—This firm has found a very simple way of obtaining nearly the theoretical yield of the mono-sulphonic acid, of which the above is the sodium salt. A mixture of molecular weights of fuming sulphuric acid and anthraquinone is heated in closed autoclaves under pressure. (Eng. Pat. 2299, 1883; and also this Journal, ii. [5], 222.)

78. PRINTING SCARLET.—The features of novelty in the preparation of this azo-scarlet are to be found in Eng. Pat. 706, 1883.

79 AND 80. XYLIDINE AND CUMIDINE SCARLETS.—In the preparation of the scarlets the naphthol is sulphonated instead of the amido-compound. (See Eng. Pat. 623, 1879.)

81 AND 82. VERMILLIONS 2B. and xB.—(See Eng. Pat. 706, 1883.)

83. ROCCELLIN.—Special method of production and improved manufacture, as already indicated when referring to 50.

85 AND 86. MALACHITE AND BRILLIANT GREENS.—Prepared from specimens 38 and 39 by the new method of condensation.

87. SYNTHETIC ROSANILINE.—Under this head Messrs. Levinstein claim improvements in the methods of producing the pararosaniline.

88, 89, 90 AND 91. PURPLE I., AND BLUES I., II. AND III.—Blue III. is the well-known "Blackley Blue," the beautiful deep shade, with inclination to violet, of which is well exhibited in the dyed skein of silk encircling the specimen tube. This colouring matter is largely used by paper makers both in Europe and America, as well as by woollen manufacturers. It was discovered in the works of Messrs. Levinstein at Blackley. As regards its chemical composition it is the sodium salt of the disulphonic acid of a diphenylated toluylated rosaniline. Since its introduction into the trade some sixteen years ago, it has largely substituted, not only ultramarine in the tinting of newspaper, but also Prussian blue used for dyeing shop and other packing papers. In conjunction with logwood and bichromate of potassium it is also extensively used for dyeing light and heavy woollen goods, producing fine heavy blue shades comparatively fast, and far cheaper and brighter than the corresponding indigo shades. Messrs. Levinstein state that since its first appearance their firm has produced over 1000 tons, representing a value of nearly one million sterling. "Blackley Blue" has been thought and indeed stated to belong to the indulins, but, as above shown, this is far from being the case.

ANILINE AND OTHER COLOURS AND INTERMEDIATE DERIVATIVES, ETC.,

EXHIBITED BY THE BADISCHE ANILIN- UND SODA-FABRIK OF LUDWIGSHAFEN A/RH. AND STUTTGART (*Group. XIV. No.* 2654).

This company, with works in Ludwigshafen, Stuttgart, Neuville sur Saône and Butirki, near Moscow, and with which the name of Heinrich Caro will be always connected, have brought together in one case specimens of their products and materials. The collection, and especially its arrangement, are striking evidences of artistic skill and scientific research. In these works, under the directorship of H. Caro, assisted by a large staff of chemists and engineers, great results have been achieved.[*] At the commencement of the catalogue of specimens issued by the Badische Anilin- und Soda-Fabrik, quite a study of itself, we find the following remarks from the pen of Dr. Caro, which form a concise introduction to the collection:—

> "Our exhibits at the International Inventions Exhibition are intended to illustrate—both from a manufacturing and scientific point of view—a series of inventions relating to the manufacture of coal-tar products.
>
> "Some of the chemicals—the commercial or scientific names of which will be found in the subjoined list—have been discovered by our chemists, others were the result of scientific research, whilst we have more or less successfully tried to render them commercially available.
>
> "Our claims to the ownership of these inventions are substantiated by due reference to the chemical literature, and to the numbers and dates of our respective patents.
>
> "The exhibits are arranged in nine different groups, the members of which are, as nearly as space would permit, placed in vertical columns. Each group is again subdivided into several inventions."

But the most fitting introduction *to a study*—not a mere inspection—of this beautiful collection would be a previous study of the admirable Address of Dr. Perkin closing the 1884-85 session of the Society of Chemical Industry (see this Journal, iv. [7], pages 427 to 438).

In the following tabulated list I have given the divisions in which the collection is arranged and catalogued with subdivisions; but in tabulating these I have re-arranged them in a more condensed form, so as to furnish what I believe will be a very useful table of reference, serving as an index to the literature, patents, and nomenclature of the dyes. The names of the individual specimens would make a long list, and the most interesting of them have been referred to by Dr. Perkin in his address, *loc. cit.* Hence it would be unnecessary to reprint them all, especially as the literature and patent list are fully given.

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[*] See President's Address, this Journal, iv. [7], page 437.

TABULATED LIST OF DYES, ETC., DISCOVERED AND MANUFACTURED BY THE BADISCHE ANILIN- UND SODA-FABRIK.

(ARRANGED BY WATSON SMITH.)

GROUPS OF SUBSTANCES REPRESENTED, WITH OTHER SUBDIVISIONS.	LITERATURE.	PATENTS.	Ex. No.	SPECIAL DETAILS OF EXHIBITS, ETC.
FIRST GROUP. *Derivatives of Triphenylmethane. Synthesis by means of Benzyl Derivatives.* I.—ACID MAGENTA, 1877. Sulphonic Acids of the Rosaniline Group.		H. Caro. Eng. Pat. 3731, October 8, 1877. Bad. Anilin- u. Soda-Fab. Ger. Pat. 2096, Dec. 16, 1877. H. Caro. U.S. Pats. 201,797, 201,798, and 250,201.		
II.—BENZALDEHYDE GREEN (VICTORIA GREEN). Manufacture of Benzaldehyde, 1878.	President's Address. This Journ. iv. [7], 430. *Ber.* 1879, p. 796 (lines 3-11).			
III.—SUBSTITUTION DERIVATIVES of Benzaldehyde and Benzaldehyde Green.	Direct Chlorination of Benzaldehyde. *Ber.* 1881, p. 752.	Trichlorbenzaldehyde Green. Ger. Pat. 25,827. Chlorbenzaldehydes. Dr. Müller. Ger. Pat. 30,329. Paranitrobenzaldehyde condensations. O. Fischer. Ger. Pat. 16,707, 16,766. Paranitrobenzaldehyde from Paranitrocinnamic Acid. A. Baeyer. Ger. Pat. 15,713.	6. 10. 4.	Dichlorbenzaldehyde Green, 1880. Paranitrobenzaldehyde, 1881. Acid Violet, 6B, 1883 (Sulphonated Benzyl-methyl Purple).
IV.—SPECIMENS OF BASIC BENZYL DERIVATIVES.			17. 19. 20. 21. 23.	Benzyl-diphenylamine. Benzylidene-aniline. Paranitrobenzyl-aniline. Paranitrobenzylidene-aniline. Dibenzyl-aniline.
V.—SPECIMENS illustrating Researches on Constitution of Rosaniline.	This Journ. iv. [7], 431. *Rosolic Acid.* Caro and Wanklyn. *Chem. News.* 1866, vol. xiv. p. 37. — H. Caro. *Phil Mag.* 1866, 125. — Caro and Graebe. *Annalen*, 179, 181. — *Ber.* 1878, 1116. *Dioxybenzophenone.* Caro and Graebe. *Ber.* 1878, 1318. *Triphenylmethane.* E. and O. Fischer. *Annalen*, 194, 212.			
SECOND GROUP. *Synthesis of the Rosaniline series by means of Carbon Oxychloride (Phosgene).* I.—PRODUCTION of colouring matters by the direct action of Phosgene on tertiary aromatic amines in presence of condensing agents.		Bad. Anilin- u. Soda-Fab. Ger. Pat. 26,016, Aug. 1883; and Ger. Pat. 29,913. Johnson, from H. Caro. Eng. Pats. 4128, Sept. 1883, 11,030, 1884. H. Caro and A. Kern. U.S. Pat. 290,856.	 44. 56. 60.	Crystallised Methyl Purple, 1883. (Hexamethyl-pararosaniline Hydrochloride). *Products resulting from the direct action of Phosgene on Tertiary Amines.* Diethylpara-amidobenzoate Para-amido of Sodium. Dimethylamido-alpha-naphthoic Acid. Hexa-methyl-triamido-dibenzoyl-benzene.
II.—PRODUCTION of Leucobases of the Rosaniline series, by condensation of Hydrol-bases with aromatic amines.		Bad. Anilin- u. Soda-Fab. Ger. Pat. 27,032, Oct. 1883. Johnson, from A. Kern. Eng. Pat. 5150, Nov. 1883. A. Kern. U.S. Pats. 290,891, 290,892, and 290,893.	39.	Hexamethyl-pararosaniline Sulphate, 1883.
III.—PRODUCTION of colouring matters by the condensation of halogen derivatives of Tetramethyldiamidobenzophenone and analogous Ketone bases with secondary and tertiary aromatic amines, 1883.	President's Address. This Journ. iv. [7], 432.	Bad. Anilin- u. Soda-Fab. Ger. Pats. 27,789, and 29,962. Johnson, from H. Caro. Eng. Pats. 1850, 5038, 11,159, 1884. A. Kern. U.S. Pats. 297,413, 297,414, 297,415. A. Kern and H. Caro. U.S. Pat. 297,416.	31. 35.	Victoria Blue B, 1884 (Condensation-product of tetramethyldiamido-benzophenone with alpha-Phenyl-naphthylamine). Victoria Blue, 4R (Condensation-product of Tetramethyldiamido-benzophenone with Methylphenyl-alpha-naphthylamine, etc., etc.).

GROUPS OF SUBSTANCES REPRESENTED, WITH OTHER SUBDIVISIONS.	LITERATURE.	PATENTS.	EX. NO.	SPECIAL DETAILS OF EXHIBITS, ETC.
IV.—AURAMINES—Condensation products of Ketone bases with Ammonia and primary aromatic amines. 1883.	President's Address. This Journ. iv. [7], 432.	Bad. Anilin- u. Soda-Fab. Ger. Pat. 29,060, March, 1881. Johnson, from H. Caro. Eng. Pats. 5512, 5741 (1881). H. Caro and A. Kern. U.S. Pat. 301,802.	31. 35.	Auramine. Commercial product, 1881. Tetramethyldiamido-benzophenone.
THIRD GROUP. *Phthaleïns.* I.—EOSINE, 1874.—Manufacture of Resorcinol and Phthalic Anhydride.	A. Baeyer. *Ber.* 1875, 116. A. Baeyer. *Annalen*, 1876, 183, 38. This Journ. iv. [7], 431.			
II.—CŒRULEÏN S.	This Journ. iv. [7], 431. Baeyer. *Ber.* for 1871. Schultz. *Chemie des Steinkohlentheers.* 1002, 1003.		68. 67.	Cœruleïn. Commercial in 1878. Cœruleïn S, 1881 (Cœruleïn Sodium Bisulphite Compound).
III.—SPECIMENS illustrating Researches on Phthaleïns, and their conversion into Anthracene Derivatives.	A. Baeyer. *Annalen*, 183, 1; 202, 36. Baeyer and Caro. *Ber.* for 1871, 969; *Ber.* for 1875, 152.		80. 76. 116. 118. 119.	Phthalophenone (Diphenylphthaleïn). Phenolphthaleïn (Dioxydiphenylphthalide). Phenolphthalideïn (Dioxyphenyl-oxanthranol), Group IV. Erythro-oxyanthraquinone. (From Phenolphthaleïn), Group IV. Quinizarine. (From Parachlorophenol), Group IV.
FOURTH GROUP. *Anthracene, Phenanthrene, Carbazol, Acridine, and their Derivatives.* Manufacture of Artificial Alizarin. I.—GRAEBE AND LIEBERMANN'S Original Process, 1868.	This Journ. iv. 7, 431, 432, 433. This Journ. ii. 213 to 227 Graebe and Liebermann. *Ber.* for 1868, 49, 101; *Ber.* for 1869, 11; *Annalen*, Suppl. 7, 257, and vol. 160, 121; *Monit. Scient.* 1879. Dr. Perkin. *Journ. Chem. Soc.* 1880, 551.	Graebe and Liebermann. Eng. Pat. 3850, Dec. 18, 1868. Graebe and Liebermann. U.S. Pat. 95,465.		
II.—CARO, GRAEBE AND LIEBERMANN'S Process, 1869.	Caro, Graebe and Liebermann. *Ber.* for 1870, 359. Graebe and Liebermann. *Annalen*, 160, 130; *Monit. Scient.* 1879. Schunck and Roemer. *Ber.* 1876, 681. Perkin. *Journ. Soc. Arts*, May 30, 1879.	Caro, Graebe and Liebermann. Eng. Pat. 1936, June 25, 1869. U.S. Pat. 153,536.		
III.—ALIZARIN-ORANGE, 1876.	*Ber.* for 1877, 1760. *Ber.* for 1879, 1008. *Monit. Scient.* 1879, 121 (Graebe and Liebermann). *Annalen*, 1880, 201, 353. President's Address. This Journ. iv. [7], 433.	Johnson, from H. Caro. Eng. Pat. 1229, March 22, 1876. H. Caro. U.S. Pat. 186,032, January 9, 1877.		
IV.—ALIZARIN-BLUE, 1878.	President's Address. This Journ. iv. 433. C. Graebe. *Ber.* 1879, 1116. H. Brunck, Graebe. *Ber.* 1878, 522 and 1610. C. Graebe. *Annalen*, 1880, 201, 333. H. Brunck and C. Graebe. *Ber.* 1882, 1783.	Bad. Anilin- u. Soda-Fab. Ger. Pat. 17,695, August 11, 1881. Johnson (from B.A.S.F.). Eng. Pat. 3603, August 18, 1881. H. Brunck. U.S. Pats. 258,530, 258,531, and 274,081.	87.	Alizarin Blue S. Commercial Product, 1881.
V.—SPECIMENS illustrating researches on constituents of crude Anthracene.	*Phenanthrene.* Graebe and Glaser, *Ber.* 1872, 861 and 968. *Diphenylene-glycollic Acid.* (H. Caro), Friedlaender, *Ber.* 1877, 126 and 531. *Carbazol.* Graebe and Glaser, *Annalen*, 163, 313. *Phenylnaphthylcarbazol.* (Brunck) Graebe, *Ber.* 1879. *Acridine.* Graebe and Caro, *Annalen*, 158, 265; *Ber.* 1880, 99. *Chrysaniline.* O. Fischer and Koerner, *Ber.* 1881, 203. *Phenylacridine.* A. Bernthsen. *Ber.* 1883, 1809.		100. 101. 105. 111. 115. 101. 120. 109. 103. 139. 116. 133.	Phenanthrene. Phenanthrenequinone. Diphenylene-glycollic Acid. Diphenylene-ketone. Diphenic Acid. Carbazol. Nitroso-carbazol. Phenylnaphthylcarbazol. Acridine Hydrochloride. Phenyl-acridine (Group V.). Diamido-phenyl-acridine (Chrysaniline). Chrysaniline Nitrate.

Groups of Substances Represented, with other Subdivisions.	Literature.	Patents.	Ex. No.	Special Details of Exhibits, etc.
FIFTH GROUP. *Quinoline.* I.—SKRAUP'S Synthesis of Quinoline and its Derivatives, 1881.	*Artificial Quinoline.* Skraup. *Monatsh. Chem.* February, 1881. *Oxyquinolines.* Skraup. *Ber.* 1882, 893. *Anisidines.* Brunck. *Zeits. für Chem.* 1867, 205.	Bad. Anilin- u. Soda-Fab. (Skraup). Ger. Pats. 11,976, February 16, 1881; 28,321, November, 1883; 30,126, June, 1884. Eng. Pat. 678, February 16, 1881. Skraup. U.S. Pats. 237,917, 237,918, 211,738, 295,825, and 308,286.	129. 131. 137.	Artificial Quinoline Tartrate. Thalline Sulphate (Paramethoxyhydroquinoline Sulphate). Thalline (Base).
II.—DERIVATIVES of Quinoline allied to the Rosaniline, artificial Alizarin and Indigo groups.			138. 87. 113. 139. 111. 119.	Quinoline Green. Second Group, III. Alizarin Blue S. and Salts. *Fourth Group, IV.* Anthraquinoline. Fourth Group, IV. Group Four, V. (see above). Monochlorquinoline. Sixth *Group, IV.* Oxycarbostyril.
SIXTH GROUP. *Artificial Indigo.* I.—CINNAMIC ACID, 1880.		Bad. Anilin- u. Soda-Fab. Ger. Pat. 17,167, Aug. 1880. Johnson, from H. Caro. Eng. Pat. 3330, Aug. 17, 1880.	148. 149.	Benzylidene Dichloride. Cinnamic Acid.
II.—SYNTHESIS of Artificial Indigo from Derivatives of *O*-nitrocinnamic Acid, 1880.	Dr. Perkin. This Journ. iv. [7], 135. *Letter from Baeyer to Roscoe.* This Journ. 1882, 17. A. Baeyer. *Ber.* 1880, 2251.	Ger. Pat. 11,858, March, 1880. Johnson, from Baeyer. Eng. Pats. 1177 and 1771, March 18, 1880; and 166, Feb. 1881. A. Baeyer. U.S. Pats. 228,300, 233,460, and 233,458. Baeyer and Caro. (Printing with Sodium Xanthate.) U.S. Pat. 210,360.		
III.—SYNTHESIS of Artificial Indigo by condensation of *O*-nitrobenzaldehyde and its Derivatives with Acetone, 1882.	A. Baeyer and Drewson. *Ber.* 1882, 2856.	Bad. Anilin- u. Soda-Fab. Ger. Pat. 19,768, Feb. 21, 1882. Johnson, from the B.A.S.F. Eng. Pat. 1266, March 16, 1882. Baeyer and Drewson. U.S. Pats. 257,813, 257,814, and 257,815. *Chlorindigo*, B.A.S.F. Ger. Pat. 32,238, March 28, 1884. *Chlorobenzaldehyde.* H. Müller. Ger. Pat. 30,329, June, 1883.	150. 152. 162. 11. 159. 156.	*O*-nitrobenzylchloride. *O*-nitrobenzaldehyde. *M*-methyl Indigo. (From *O*-nitro-*m*-xylylaldehyde.) Dichlorbenzaldehyde, Group I. *O*-nitrodichlorbenzaldehyde. Tetrachlor-indigo.
IV.—SPECIMENS illustrating Researches on Artificial Indigo.	A. Baeyer. *Ber.* 1880, 2251; 1881, 1741; 1882, 775. Friedlaender. *Ber.* 1882, 332.			
SEVENTH GROUP. *Methylene Blue*, 1877. I.—PRODUCTION of Methylene Blue from Nitroso-, Nitro-, Azoxy-, Azo-, and Amido Derivatives of Dimethylaniline.	*Nitrosodimethylaniline.* Baeyer and Caro. *Ber.* 1874, 809 and 963. *Methylene Blue.* Bernthsen, *Ber.* 1883, 1025.	H. Caro. Eng. Pat. 3751, Oct. 9, 1877. B.A.S.F. Ger. Pat. 1886, Dec. 15, 1877. H. Caro. U.S. Pat. 204,796.		
II.—SYNTHESIS of Lauth's Violet, 1883.	Bernthsen. *Ber.* 1883, 1025 and 2896; also 1884, 611, 2851, 2857, 2860.	B.A.S.F. (Bernthsen). Ger. Pat. 25,150, May, 1883. Bernthsen. U.S. Pats. 286,526 and 286,627.	172. 176. 177. 180.	Thiodiphenylamine. Alpha-Dinitro Derivative of Thiodiphenylamine. Lauth's Violet. (Amido-imido Derivative of Thiodiphenylimide.) Methyl-thiodiphenylamine.
EIGHTH GROUP. *Azobenzene and its Derivatives.* I.—PALATINE ORANGE, 1869. Manufacture of Azobenzene and Benzidene.	Schultz. *Chem. des Steinkohlentheers*, p. 779. Fehling's *N. Handwörterb*, vol. iii. 791.		182.	Palatine Orange (Commercial Product). Ammonium Salt of Tetranitro-γ-diphenol.

GROUPS OF SUBSTANCES REPRESENTED, WITH OTHER SUBDIVISIONS.	LITERATURE.	PATENTS.	Ex. No.	SPECIAL DETAILS OF EXHIBITS, ETC.
II.—AMIDO DERIVATIVES OF AZOBENZENE. Fast yellow.	*Chrysoidine. Ber.* 1877, 388.		186. 187. 192.	Fast Yellow (Sodium Amidoazobenzene Sulphonate), 1878. Helianthin (Sodium Dimethylamidoazobenzene Sulphonate), 1877. Chrysoïdine (Diamidoazobenzene Hydrochloride), 1875.
III.—INDULINS. By-products of the Indulin-process.	Fehling's *N. Handwörterb*, vol. iii. 791 ("Induline").		183. 184. 191. 194. 195.	Indulin from Azobenzene. (Commercial Product.) Sodium Indulin Sulphonate. (Commercial Product.) *By-Products of the Indulin Process.* Azophenin. Fluorindin. Calcium Fluorindin Sulphonate.
IV.—SAFRANINS.	Schultz. *Chem. des Steinkohlentheers*, 1019. *Ber.* 1883, 166.		188. 189. 185.	Paranitraniline. Paraphenylenediamine Hydrochloride. Phenosafranin.
NINTH GROUP. *Naphthol Derivatives.* I.—NAPHTHOL YELLOW S., 1879.	Lauterbach. *Ber.* 1881, 2028. Graebe. *Ber.* 1885, 1126.	B.A.S.F. Ger. Pat. 10,785, Dec. 28, 1879. Johnson from H. Caro. Eng. Pat. 5305, Dec. 29, 1879. H. Caro. U.S. Pat. 225,108.	212. 199. 198. 197. 200.	Alphanaphthol. Alphanaphthol - potassium Trisulphonate. Dinitro-alpha-naphthol monosulphonic Acid. Naphthol Yellow S. (Potassium Salt of Dinitro-alpha-naphthol Sulphonic Acid). *Commercial Product.* Di - imido - alpha - naphthol Monosulphonic Acid.
II.—CONVERSION of Naphthols into Naphthylamines by the action of ammonia and amines. Manufacture of Beta-Naphthylamine, 1879.	*Phenylnaphthylamines. Phenylnaphthylcarbazol. Ber.* 1870, 2212. Graebe. *Ber.* 1880, 1819.	B.A.S.F. (H. Caro). Ger. Pat. 11,612, Feb. 1880. B.A.S.F. (C. Glaser). Ger. Pat. 20,760, Nov. 1881.		
III. — AZO-COLOURS produced by combination of Beta-Naphthol and its sulphonic acids with the diazo - compounds of amido-azobenzene and its homologues.	*Azo-colours from the Diazo Compound of Amidoazobenzene.* H. Caro and C. Schraube. *Ber.* 1877, 2230; and 1880, 803.	F. Koehler. U.S. Pats. 224,927 and 224,928. Schuncke. U.S. Pat. 216,221.	207. 208.	Fast Scarlet (Combination of Diazo azo-benzene Sulphonic Acid with beta-Naphthol), 1878. Archil Red (Combination of Diazo - azo - xylene with beta-naphthol Disulphonic Acid), 1880.
IV. — AZO - COLOURS produced by combination of Beta-Naphthol and its sulphonic acids with the diazo-compounds of *O*-anisidine, its sulphonic acids and homologues, 1878.		B.A.S.F. Ger. Pat. 12,151, Jan. 1879. J. P. Griess. Eng. Pat. 4726, Nov. 20, 1878. J. P. Griess. U.S. Pats. 213,563 and 213,501.	226. 218. 206. 219. 222. 209.	*O*-nitranisol Calcium Sulphonate. *O*-anisidine Calcium Sulphonate. Anisol Red (from *O*-anisidine and beta-Naphthol monosulphonic Acid). Anisol Red (from No. 218, above, and beta-Naphthol monosulphonic Acid). Ethyl *O*-amido-cresylate. Cresol Red (from 222 and beta - Naphthol - disulphonic Acid).
V.—AZO-COLOURS by combining Naphthols and their sulphonic acids with the diazo-compounds of Alpha - Naphthylamine and its sulphonic acids (Oxy-azonaphthalene sulphonic acids, 1877).	J. P. Griess. *Ber.* 1878, 2199 ("Fast Red.")	B.A.S.F. Ger. Pat. 5411, March 12, 1878. Johnson, from H. Caro. Eng. Pat. 786, Feb. 25, 1878. H. Caro. U.S. Pat. 201,709.	211. 223. 215. 230. 221. 213. 214.	alpha-Naphthylamine. Calcium Naphthionate. Fast Brown (from No. 223 and alpha-Naphthol). Fast Red (from No. 223 and beta-Naphthol). Fast Red (from Clève's beta-Nitronaphthalene sulphonic Acid and beta-Naphthol). Fast Red C. (from 211 and alpha-Naphthol monosulphonic Acid). Fast Red D. (from 223 and beta-Naphthol Disulphonic Acid).

(To be Continued.)

Journal and Patent Literature.

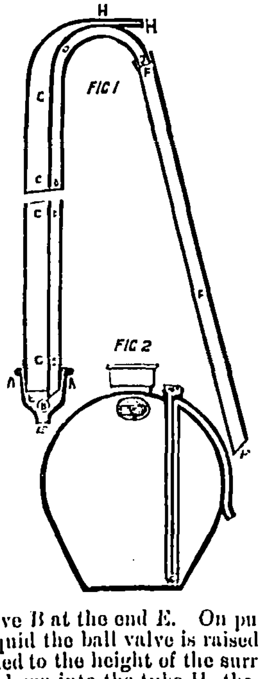
I.—GENERAL PLANT, APPARATUS, AND MACHINERY.

On the Construction of Chimneys. L. Ramdohr. Chem. Zeit. **9**, 903.

THE author recommends the construction of chimneys with equal inside width from the base to the top. There are two ways of building such chimneys—viz. (1) dressing the bricks in nearly every course of the brickwork, which plan involves a great deal of troublesome work and waste of material, and is therefore not advisable; or (2) building the chimney in several steps, and giving the top end of each step the normal width intended. The height of these steps should not exceed 5·5 metres. As regards the calculation for the inside width of the chimney, it is essential that its narrowest section be nearly equal to the sum of the air spaces left between the fire-bars. This width must even be increased for low chimneys, whereas it may be a little diminished for high ones. For small boilers or furnaces, the chimney need not be higher than 16m.; for large furnaces a height of 35m. is sufficient, if the chimney be not far from the fire; but if the distance be considerable the height must be increased to 50—60m., whereas the width may be diminished tofrom $\frac{1}{2}$ to $\frac{1}{3}$ of the calculated width. The flues leading to the chimney should at least be as wide as the sum of the air spaces between the bars. For the base well-burnt bricks are better than quarry stones. The cap has an inclination of 30° to the outside. The thickness of the brick-work at the top should in no case be less than 20cm.—S. H.

A New Syphon. Chem. Zeit. **9**, 907.

BODE and Wimpf have designed a new kind of syphon, which is of great use for syphoning off acid, caustic or poisonous liquids. Its special feature is due to the fact that it is not set by suction, but by blowing so that the liquid to be syphoned off can never get into the mouth. Fig. 1 represents the construction. The tube D is surrounded by a wider one C, closed at the top, and provided with a ball valve B at the end E. On putting the apparatus into a liquid the ball valve is raised, and the tubes C and D are filled to the height of the surrounding liquor. If now air be blown into the tube H, the valve is closed, and the liquid being driven from C into D and F sets the syphon to work. The blowing is then discontinued and H closed. If it be desired to interrupt the flow, it is only necessary to blow again a little stronger through H. The valve B is now pressed into its seat, and no liquor being able to enter the syphon, it empties itself. The syphon need never be removed from the liquid, either at the start or at the end. C. Gerhard, of Bonn, and the Möncheberg Pottery, are prepared to supply the syphon to the trade. It can be made of glass, earthenware, ebonite, indiarubber, and metal. It is also intended to fit Woulff's bottles with this syphoning arrangement, as shown in Fig. 2, for drawing off acids in the course of the manufacture.—S. H.



Improved Anti-incrustation Composition for Steam Boilers. A. M. Clark. From Van Baerle & Co. Eng. Pat. 11,518, August 21, 1884.

THE composition consists of silicate of soda or potash, with or without the addition of alkali in any form.

—H. J.

II.—FUEL, GAS, AND LIGHT.

Improvements in Coke-Ovens. Dingl. Polyt. J. **256**, 359.

SACHSE (Ger. Pat. Add. 30,021, June 18, 1884) now gives his horizontal coke-oven a rectangular cross section throughout, the walls are perpendicular, and the top is not built vaulted, but consists of plates of iron lined with refractory clay laid upon the upright walls. Spaces between the walls and plates, or between contiguous plates, are luted with clay. The advantages of this new system are, *that immediately after the introduction of* the charge it can be stamped down, and also that any part of the oven may be made accessible from above, either during work or rest.

Fig. 1.

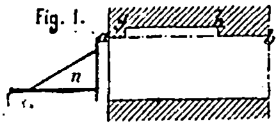


Fig. 2

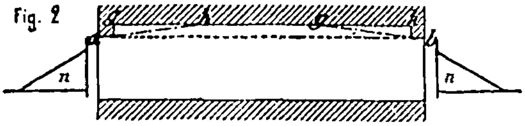
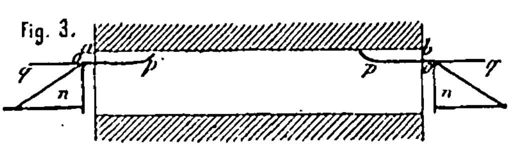


Fig. 3.



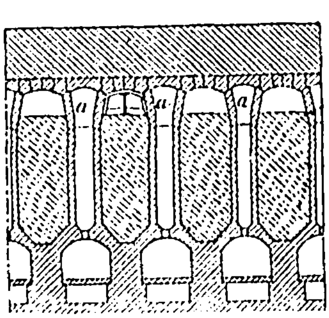


Fig. 4

The arrangement adopted by Lürmann (Ger. Pat. 29,557, June 14, 1884, Add. to 18,093) for compressing coal in coking it in horizontal ovens, is illustrated in

Figs. 1, 2, and 3. As shown in Figs. 1 and 2, the roof is made somewhat higher in part to allow free passage for the gases evolved. The compression is obtained by means of *nn*. The arrangement shown in Fig. 3 is adopted when it is desirable not to make any alteration in the roof. A passage for the gases is maintained or obtained by means of the iron arrangement *op*, which may be either fixed or movable. In the latter case the size of the gas passage is regulated by the distance to which *op* is inserted.

To increase the yield of by-products from the distillation gases of coke-ovens, Brunck covers the material under treatment with a layer of small coke, lime, or the like, and also makes an addition of lime to the charge to

Fig. 5.

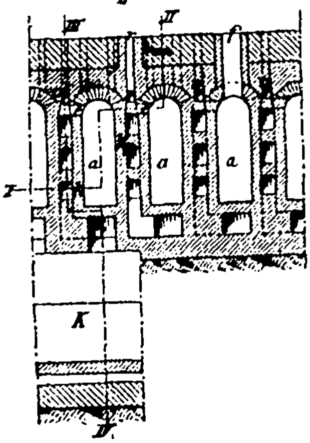


Fig. 6.

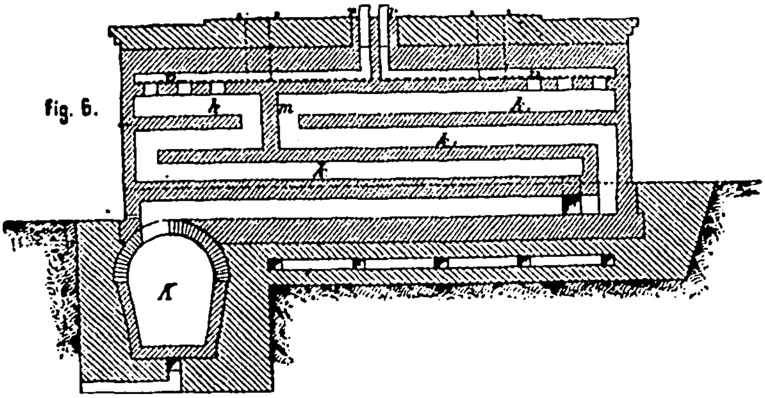


Fig. 7.

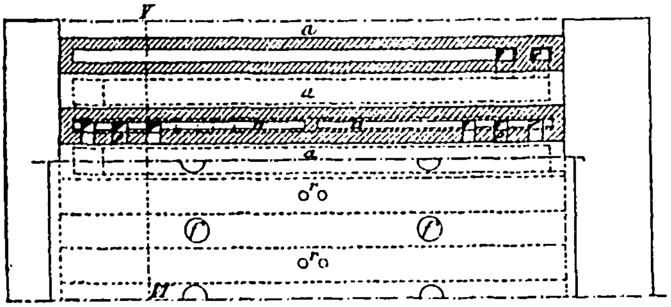


Fig. 8.

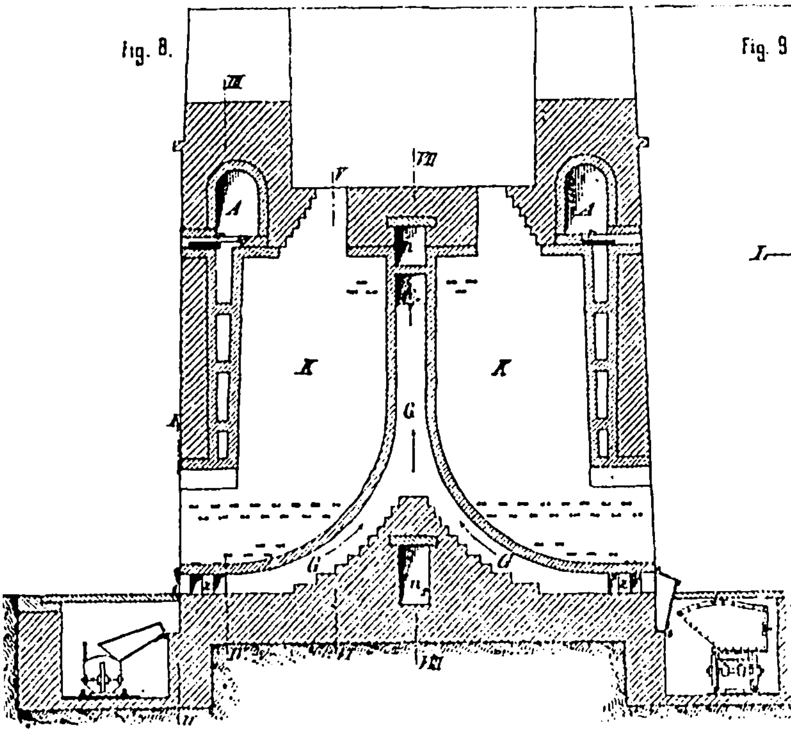
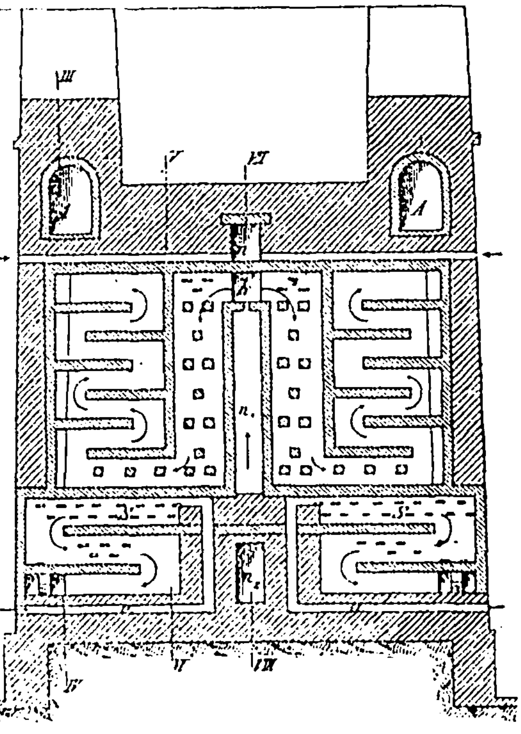


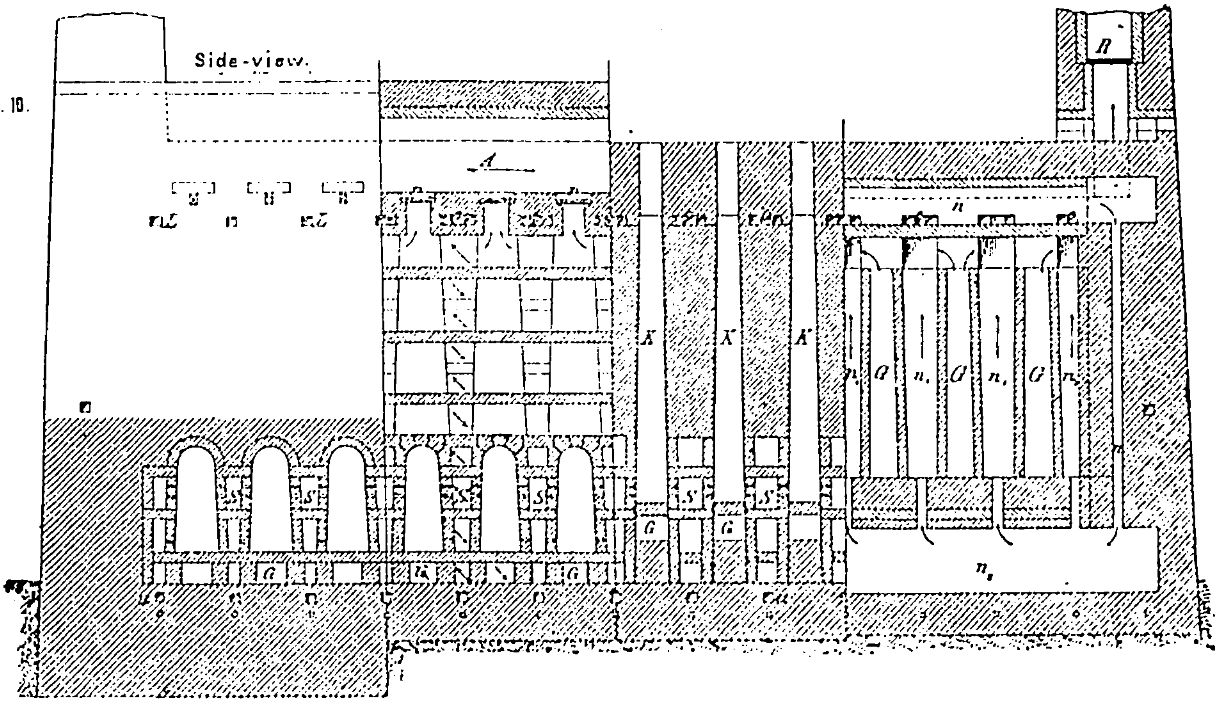
Fig. 9



increase the yield of ammonia (Ger. Pat. Add. 29,018, Dec. 21, 1883). The arrangement of the oven is shown in Fig. 4.

In order to increase the durability of coke-ovens with horizontal gas canals, Brzezowski (Ger. Pat. 29,228, March 12, 1884) collects the gases at two different points in the upper part of the chamber, and by thus dividing the stream of gas is enabled to reduce the sectional area of the gas passages. Figs. 5 and 6 are sectional views, Fig. 7 is the plan of the arrangement and construction. The distillation gases pass from the chambers *a* through horizontal channels *c* at each end of the upper part of the chambers, into the channels *k*, *k*, disposed horizontally one above the other. Above the gas channels are air passages *v*, connected with the outer air by the tubes *r*. Air is supplied by means of *r v* into the gas passages *k* and k_1, the draught caused by the chimney in connection with the main gas canal *k* being quite sufficient to produce the in-current of air. The distillation gases are thus inflamed as soon as they pass from *a*. By the partition wall *m* being built from above, and not extending the whole depth of the gas passages, the necessity for a double main is obviated.

Fig. 10.



In Bauer's upright coke-oven, illustrated by Figs. 8, 9, 10 (Ger. Pat. 28,530, February 26, 1884), the distillation products proceeding from the coking chamber K proceed through a double series of slits near the bottom of the chamber into the passage S, and there meet air which enters at *a*, and is warmed before mixing with the distillation gases in S. The mixed air and gas in a state of combustion is drawn from the lower part of S through the channel *z* into the passage G beneath the hearth of the chamber, proceeds through the vertical portion of G upwards, and at the top, just beneath the cover of the chamber, mixes with air introduced in regulated amount at L, and heated by passing through the horizontal passage *n*, downwards into n_2, and thence into the upright passages *n* situate between the gas passages G mentioned above. At the top of n_1 are slits through which the hot air passes into *k*, there to meet the stream of burning gases from G. Near this point a small number of slits in the wall of K allow a further amount of the distillation gas to mix with the gases from G, and the hot air from *c*; the direction now taken by the current is shown by the arrows. The draught is regulated by registers *r* at the entry into the outlet A, and further by the chimney register R. The gases may be collected to be worked for tar and ammonia, either just beneath the cover of the chamber or near the fire door at the lowest part of the hearth.—W. D. B.

Report of Experiments in the König Coal Mine, on the action of Shot-firing on Coal-dust and Firedamp. Chem. Zeit. **9**, 641.

The experiments have, so far, had the following practical results:—(1.) In the presence of coal-dust, which occurs in mines in the neighbourhood of the concussion, the normal flame length of a shot is always more or less extended. (2) *a*. In the complete absence of firedamp the length of the flame is a limited one, and does not exceed, however far the dust extends, 6 to 15 metres, for most kinds of dust, provided that clay is used, and the walls of the bore do not give off gas with the explosion; 9 to 21 metres, if coal-dust is used as covering, or the walls of the bore, with the action of the blast, give off dust and gas. *b*. There are also certain kinds of coal-dust which are ignited by shot-firing, and when once ignited burn on and give not only flame of great length, but also the phenomena of an explosion, when no firedamp is actually present. (3) *a*. By the presence of small quantities of firedamp all the effects of combustion are intensified; nevertheless those kinds of coal-dust which alone give flames of a limited length, produce with firedamp up to 3 per cent. only a moderate lengthening of the flame, but not by any means an expansion throughout the length of the dust present. *b*. If, however, the percentage of firedamp is 4 per cent. or more, these kinds of dust give an unlimited transfer of flame, which otherwise would not be the case. *c*. Those kinds of dust, which of themselves conduct the flame unlimitedly, give with less than 3 per cent. of gas, real explosions. (4.) By means of coal-dust isolated regions containing firedamp even at great distances may become connected with the scene of the shot-firing, and will produce an explosion, even though no fire-damp has been originally present at that spot.—J. B. C.

The Gaseous Products of the Combustion of Coal. A. Scheurer-Kestner. Bull. Mulhouse, 1885, 328.

This is a reply to the criticisms of F. Fischer contained in a recent article (*Polyt. J.* 251, 323). The author reasserts the statements made by him in 1868, in regard to the trustworthiness of analyses of these products after having been collected over water, as representing the actual result of the combustion of the coal.

In regard to the influence of the supply of air upon the combustion, the author corrects certain misrepresentations, by restating his former conclusions, that to obtain the maximum effect from a coal, about one-third of the air supplied should remain unused.—C. F. C.

On the Reduction of Carbon Dioxide to Carbon Monoxide, by means of Carbon. A. Naumann and C. Pistor. Ber. **18**, 1647-1657.

WATER-GAS, which is formed by passing steam over incandescent coal, does not only contain carbon monoxide and hydrogen, but also carbon dioxide, often in very considerable quantities. The reaction expressed by the equation, $H_2O+C=CO+H_2$ is, in fact, only a desirable maximum which can never be fully attained. The authors attempted to find out how far the completeness of the reaction depends on the temperature. For this purpose a combustion-tube filled with purified charcoal was heated in a combustion furnace while dry and pure carbon dioxide was passing through it. For measuring the temperature a number of small glass tubes filled with salts or metal wires of known fusing point was uniformly divided amongst the charcoal in the combustion-tube, and according as one salt was fused at the end of an operation and another was not fused, the temperature was considered to lie between these limits. The analysis of the gas which escaped at the end of the tube was performed according to Bunsen's method. The results of the experiments will be seen from the following table :—

No. of Experiment.	Length of layer of Charcoal.	Temperature.	Inside diameter of Combustion-tube.	Number of gas-bubbles per second.	Percentage of CO in the gas after passing incandescent coal.
1	66cm.	Less than 501° C.	15mm.	From 2 to 3	None
2	66cm.	Between 530° and 585° C.	15mm.	,, 2 to 3	Trace
3	66cm.	,, 530° and 602° C.	15mm.	,, 2 to 3	12·6%
4	10cm.	602° C.	15mm.	,, 2 to 3	None
5	10cm.	Between 634° and 703° C.	15mm.	,, 2 to 3	Trace
6	30cm.	Less than 814° C.	8mm.	1·0 90cc. in 16min.	12·7%
7	24cm.	Between 861° and 954° C.	8mm.	1·7 100cc. in 10min.	58·3
8	10cm.	,, 954° and 1054° C.	8mm.	1·2 135cc. in 18min.	94·2
9	57cm.	,, 861° and 954° C.	8mm.	3·0 150cc. in 8min.	90·7
10	2cm.	,, 1035° and 1100° C.	6mm.	3·0 70cc. in 4min.	18·1
11	4cm. C + 8cm. Cu + 4cm. C + 8cm. Cu + 2cm. C.	,, 861° and 954° C.	8mm.	2·0 100cc. in 8min.	30·5

—S. H.

Obtaining Sulphur from Furnace Gases. Emil Hänisch and Max Schroeder, Neumühl-Hamborn, Prussia. Eng. Pat. 6404, May 26, 1885.

THE sulphur dioxide, after separation from the accompanying gases, by absorption in a water-tower with subsequent boiling of the aqueous solution, is led first through a vertical cylinder containing carbonaceous material, heated externally by producer gas, whence a mixture of sulphur vapour and unchanged sulphur dioxide with the oxides, sulphide, and oxy-sulphide of carbon is obtained. This mixture is then passed through an externally heated cylinder, filled loosely with fire-brick; here a mutual reaction occurs resulting in sulphur (in the gaseous state) and carbon dioxide—

$$SO_2+C=S+CO_2.$$

Carbon monoxide may be substituted for carbon—

$$SO_2+2CO=S+2CO_2.$$

To effect the reaction with this gas half of the carbon dioxide produced in the reaction is returned and passed through the first cylinder, where it becomes converted into the mon-oxide, afterwards meeting with the sulphur dioxide which, in this case, is introduced into the channel between the two cylinders, the reaction taking place solely in the second of these. The sulphur vapour is condensed and collected in suitable chambers.

—W. G. M.

On Explosions caused by Dust. C. Engler. Chem. Ind. **8**, 171.

OWING to repeated explosions in the lamp-black works of the Black Forest, the author investigated the causes of such accidents. These may be produced by igniting a mixture of (1) combustible gases with air; (2) fine particles of coal or soot with air; and (3) combustible gases and soot with air. The conditions under which combustible gases explode with air have been clearly defined by Bunsen, Winkler, and Wagner. On the second point the author found that a thick cloud of common coal soot produced in an apparatus devised for that purpose can neither be ignited by a "naked" light nor by the induction spark of a powerful Ruhmkorff. Clouds of flour, sulphur, naphthalene, or colophonium ignite at once very vigorously, especially the last with explosive force. Soot being in a hot state in the soot-chambers, a cloud of soot and charcoal, 300° C. hot, was produced in the apparatus, but on introducing a light no transmission of the flame could be observed. It therefore appears that explosive effects are only produced by those substances which on heating give off combustible gases.

Heat of Combustion of Ronchamp Coal. A. Scheurer-Kestner. Bull. Mulhouse, 1885, 333.

THE author's previous results on this subject have been criticised by Bunte and Stohmann. With the view to end the controversy on the point at issue between them, the author appeals to recent numerical results which entirely confirm the preceding. The mean composition of the coal, ash free, and dried at 110° was: C, 89·09; H, 5·09; N, 1·30; O, 4·52 per cent., the heat of combustion for 1grm. 9130cal. Calculating from the composition of the coal—the calculation including a deduction for the hydrogen burnt at the expense of the oxygen of the coal, according to Dulong—the number of calories is 8761, the difference being 369, or 4·25 per cent. The author upholds therefore the statements on this subject made by himself and his collaborateur, Meunier-Dollfus, in 1868-1870.—C. F. C.

Hilt arrived at the same conclusion when investigating explosions in coal-pits caused by coal-dust. A series of experiments was also made on the nature of air mixed with coal or soot particles and combustible gases.

	Vols. per cent. illuminating gas and coal-dust.	
Air, containing	12·3	ignites with violent explosion
" "	10·2	" " "
" "	9	" " "
" "	8	" " "
" "	7	ignites quickly without explosive force
" "	5·6	" " "
" "	3·5	" " "
" "	2·1	does not ignite

Further experiments showed that air containing 7·5 per cent. illuminating gas and no coal-dust cannot be ignited under the same conditions, and it is therefore evident that a gas mixture, which is harmless by itself, burns with an explosive force when *mixed with coal-dust*. The same experiments made with marsh gas gave an equal result.—S. H.

Improvements in the Treatment of Gas and in the Materials and Apparatus employed therein. F. Leslie and J. A. Wanklyn, London.

THIS invention relates to the carrying out of a process described by the above patentees in their Provisional Specification 419, January 12, 1885, which consists in separating gas into two qualities for heating and lighting. This process depends upon the fact that the former is lighter and passes more readily through a partition of porous material. It is now stated that this separation can be much more easily effected in the presence of an oily or fatty substance. The apparatus consists of a cylinder with closed ends, having a division of wire gauze, upon which rests the porous material employed. Below the gauze two pipes enter the cylinder; one admits coal gas in its ordinary condition, and the other allows the heavy illuminating gas to pass away. Above the gauze is another exit pipe to carry off the light heating gas which has made its way through the porous material. For this last, linseed meal is recommended, but any crushed oily seed will answer, as will also fragments of stearic acid, tallow, pieces of cork, bark, or such like, coated with oil or lard.—A. R. D.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

A New Lutidine. A. Ladenburg and C. F. Roth. Ber. **18**, 1590

FROM that fraction of bases obtained from Dippel's oil boiling at 174—176°, a third lutidine has been obtained by precipitation with $PtCl_4$. The platinum double salt forms a voluminous precipitate of a dark orange colour, which easily decomposes. On recrystallisation it is obtained in needles or pointed plates of a characteristic bronze colour. The hydrochloride of the base is obtained from the platinum salt by means of H_2S, and with potash the free base is separated. It is an oil distillable with steam and possessing the penetrating smell of lutidine (B. P. 174—176°).—J. B. C.

The Decomposition of the Terpenes by Heat. Berthelot. Ann. Chim. Phys. (6), **5**, 136.

TILDEN'S experiments confirm the views long held by the author—viz., that the terpenes do not belong to the aromatic series, but are formed by polymerisation of the double amylene, C_5H_8.—J. B. C.

Valuation of Ozokerite. Lach. Chem. Zeit. **9**, 905.

ONE HUNDRED grms. ozokerite are treated with 20grms. fuming sulphuric acid in a tared basin. The mixture is heated from 170 to 180°, and continuously stirred until all sulphur dioxide has escaped. On reweighing the difference presents the yield of volatile products—viz., petroleum and water. Another quantity of ozokerite is mixed with 10 per cent. of decolourising powder (residues from the manufacture of prussiates), previously dried at 140° C. A tenth part of the mixture is weighed off and put into a small cylindrical filter, closed at the bottom, whose weight is known, when dried at 130° C. The contents are then extracted with benzene in a small extracting apparatus. The filter is dried at 130° C., and reweighed, and from the loss the percentage of wax can be calculated. By evaporating the benzene solution and drying the residue at 180° C., this result may be verified, while the melting point of the wax can also be ascertained.—S. H.

Improvements in Separating Solid Paraffin from Oils. G. T. Beilby, Midcalder. Eng. Pat. 11,987, September 4, 1884.

THIS invention relates to apparatus for cooling and crystallising paraffin oils in a state of repose, and has reference also to the breaking up of the solidified mass, and feeding the same to the apparatus used for separating the solid portions of the paraffin from the liquid portions. The apparatus consists of a narrow vertical cell whose outer walls are exposed to the cooling influence of the air; in the lower part a rotating screw is arranged horizontally and longitudinally, which by its action breaks up the solidified mass in the cell and discharges it continuously into pipes leading to a filter-press.—D. B.

An Improved Process and Apparatus for Extracting Benzene from the Gases evolved in Sealed or Closed Coke-Ovens. John Coates, London. Eng. Pat. 11,202, May 1, 1885.

AFTER passing through the ammonia scrubbers the gases are drawn through one or more rectangular washers, made perfectly gas-tight, and containing tubes or plates so disposed as to cause the gas to pass through the washing liquid, which is preferably an oil having an affinity for benzene. From the washers the gas passes up a scrubber consisting of a tower packed with boards, coke, tiles, or other suitable material down which the absorbing oil is allowed to trickle. The oil is drawn off and the benzene distilled from it by any known process.
—A. R. D.

IV.—COLOURING MATTERS AND DYES.

Dioxypyrenequinone. H. Reinherz, Ger. Pat. 31,091, July 16, 1884; and Dingl. Polyt. J. **256**, 323.

AFTER heating one part pyrenequinone with 4—5 parts concentrated sulphuric acid *at a temperature* of 180—210° for 2—3 hours, the disulphonic acid is obtained. On purifying somewhat with calcium or lead salts, and heating with potassium or sodium lye, or fusing with solid caustic alkali, the potassium or sodium salt respectively of dioxypyrenequinone is obtained, the red coloured aqueous solution of which gives coloured precipitates with lead acetate and metallic chlorides. Hydrochloric acid precipitates the dioxy-compound as a reddish-brown powder, which can be purified by recrystallising from alcohol. The alkaline salts of the bisulphonic acid are almost colourless, and are somewhat difficultly soluble in water; the solutions, however, are red in colour, and can be used for dyeing Dioxypyrenequinone can also be obtained by treating one molecule pyrenequinone with two molecules bromine in a closed vessel at 90—115° for 2½ hours, and then heating the light-red dibrom-pyrenequinone with an alkali.
—J. T.

Preparation of Rosaniline Dyes. E. Erlenmeyer. Ger. Pat. 30,357, February 21, 1884; and Dingl. Polyt. J. **256**, 324-325.

THE author recommends the preparation of these dyes by the oxidation of certain compounds of methylated amines with primary, secondary and tertiary aromatic amines. Pararosaniline, for example, is to be prepared by heating 120 parts dimethylaniline, 465 parts aniline, and 920 parts of 75 per cent. arsenic acid, or 123 parts methyl-violet, 501 parts aniline and 558 parts arsenic acid, at 189° C., with agitation, and maintaining this temperature until a test becomes solid on cooling. The mass is boiled in water, the extract is heated with common salt equal in amount to the portion treated with water, and the bluish-green hydrochloride is precipitated with common salt. Or, 180 parts dimethylaniline, 300 aniline hydrochloride, 555 nitro-benzene, and 15 iron-filings; or, again, 205 parts methyl-violet, 582 aniline chlorhydrate, 555 nitro-benzene, and 15 iron-filings, are heated very gradually to 180° with stirring, and maintained at this temperature until a cooled test becomes solid; the mass is then boiled, with the addition of some hydrochloric acid, and the filtered extract is salted out. Corresponding violet and blue dyes, as in the case of methyl-violet by the copper chloride process, can be prepared by oxidising dimethylaniline in combination with diphenylamine, etc., by oxidising with copper chloride. Also the action of a zinc chloride on the compound of methylphenylnitrosamine, with dimethylamine and analogous compounds, produces violet and blue dyes.—J. T.

Formation of Quinones from Paramethylated Amines. E. Noelting and T. Baumann. Bull. Mulhouse, 1885, 305.

THE authors find that quinones are formed in the oxidation of the parametbylated amines by chromic acid, provided the latter is added in sufficient quantity. The following are the proportions of the reagents employed in the authors' experiments:—Base 5, water 500, chromic acid 15, sulphuric acid (60° B.) 25 :—

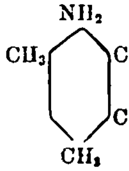
Paratoluidine gave traces only of the quinone. *Metaxylidine*, $C_6H_3.NH_2.CH_3.CH_3$ (1, 2, 4), yielded toluquinone, $C_6H_3.O.CH_3.O$ (1, 2, 4) (m. p. 70°), in small quantity. *Orthoxylidine* (1, 3, 4) yielded a quinone, but the quantity obtained (from 4grms.) was too minute for identification. *Mesidine*, $C_6H_2.NH_2.(Me_3)$ (1, 2, 4, 6), yielded metaxyloquinone, $C_6H_2.O.CH_3.O.CH_3$ (1, 2, 4, 6), melting at 72°. The yield in this case was large, 5grms. of the base giving 2grms. of the quinone. *Pseudocumidine*, $C_6H_2.NH_2.(Me_3)$ (1, 2, 4, 5), yielded the corresponding quinone. A quantity equal to 20 per cent. of the weight of the original base was obtained in the pure state (m. p. 123°); a further quantity which remained dissolved in the mother-liquor was converted into the hydroquinone (m. p. 210°) which was isolated (comp. *J. Prakt. Chem.* 23, 429. *Isoduridine*, $C_6H.NH_2.(Me)_4$ (1, 2, 3, 4, 6), under the same treatment, yielded a cumoquinone which was converted into the corresponding hydroquinone (m. p. 169°) by the action of sulphurous acid upon the aqueous distillate from the mixed products of oxidation. The quinone was subsequently obtained by oxidising the hydroquinone. It is liquid at the ordinary temperature of the air, crystallising in yellow needles at 11°.—C. F. C.

Some Derivatives of Pseudocumidine. E. Noelting and T. Baumann. Bull. Mulhouse, 1885, 309.

THE authors having previously shown that a crystalline cumidine is formed by the action of methyl-alcohol upon the hydrochlorate of both para- and orthoxylidine, and that its constitutional formula is, therefore, $C_6H_2NH_2.(Me_3)$ (1, 3, 4, 6), have now established the identity of this base with that obtained by Schäper (*Zeit. Chem.* 1867, p. 12) by amidating pseudocymene (comp. Hofmann, *Berl. Ber.* 15, 2895). In the course of their researches the authors have prepared the following derivatives:—

Acetocumidine: White needles, soluble in alcohol, slightly in water, m. p. 161°. *Diazoamidocymene* was obtained by diazotating the base, and treating the product with cumidine in acetic acid solution. It crystallises in transparent tables (m. p. 130°). *Amidoazopseudocymene* was obtained by heating the diazo product (20 pts.), with cumidine (40 pts.), and cumidine hydrochlorate (13 pts.), at 80°. From the product, after distilling away the excess of cumidine, the amidoazo compound was dissolved out by means of ether, and precipitated by hydrochloric acid from its ethereal solution. The free base crystallises from its solution in alcohol, in orange-coloured plates (m. p. 138°). By reduction with stannous chloride it is converted into a mixture of cumidine and cumylenediamine, from which the latter is easily isolated. It crystallises in white needles, m. p. 91°.

An amidotetramethylbenzene was formed by heating the hydrochloride of cumidine with methyl-alcohol at 200—300°. It was obtained as a liquid boiling at 245—250°, crystallising at −10°. The hydrochloride crystallises in white needles. Mesidine similarly treated yielded an identical amidotetramethylbenzene. The base in question was, moreover, found to be identical with that recently isolated by Hofmann (*Ber.* **17**, 1912) from amongst the by-products of the transformation of xylidine into cumidine. It is hence to be regarded as a derivation of isodurene, and may be designated isoduridine.



—C. F. C.

The Use of Poisonous Colours. Chem. Zeit. **47**, 832.

AT the meeting of the Verein zur Wahrung der Interessen der Chemischen Industrie Deutschlands held on April 25, the report of the commission appointed to consider the use of poisonous colouring materials was adopted. The commission defined poisonous colouring materials to be all those colours or colour preparations which contain:—A. Antimony, arsenic, lead, chromium (with the exception of pure chromium oxide), copper, mercury, cinnabar, gamboge, and picric acid; B. Barium (but not barium sulphate), heavy spar, cadmium, zinc, and tin. The use of all these for colouring foods or food stuffs is forbidden. Those enumerated under section A should be so packed for transit as to render the loss of any of the poisonous substances impossible, and, with the exception of lead chromate, are not to be used for colouring toys. The use of arsenic for wall papers is forbidden. Wall-paints containing copper and arsenic are to be discontinued. The sale of articles coloured with poisonous materials as above defined is to be made illegal. The report has been forwarded to the German Government.—S. R.

Valuation of Indigos. (Abstract of a paper read before the Society of Dyers and Colourists.) Ch. Rawson. Jour. Soc. Dyers and Colourists, 1885, 74.

THE principal colouring matter in indigo is indigotin, in addition to which indigo red, indigo brown, indigo gluten, and mineral matters are present. The different shades obtained in the dye-bath are due to the indigotin and indigo red present; the other bodies producing little or no effect. The methods of analysis may be classed under the following heads:—

I. By oxidation of sulphindigotic acid.
II. By loss on sublimation.
III. By reduction to indigo white in an alkaline solution.

I. *Oxidation of Sulphindigotic Acid.*—To obtain a solution of sulphindigotic acid, 1grm. of finely-powdered indigo is intimately mixed in a small mortar with its own weight of ground glass. The mixture is gradually and carefully added during constant stirring with a glass rod to 20cc. of concentrated H_2SO_4 (sp. gr. 1·845) contained in a cylindrical porcelain crucible (cap. 1½oz.); the mortar is rinsed out with a little powdered glass, which is added to the contents of the crucible, and the whole is exposed in a steam-oven for a period of one hour to a temperature of 90° C. The sulphindigotic acid thus formed is diluted with water and made up to a litre. The solution must be filtered, in order to separate certain insoluble impurities, which otherwise would interfere with the subsequent operations. 50cc. of the clear solution are measured into a porcelain dish, to which are added 250cc. of distilled water. To this diluted liquid a solution of permanganate of potash (0·5 grm. per litre) is gradually run in from a burette until the liquid, which at first takes a greenish tint, changes to a light yellow, the sulphindigotic acid being converted by oxidation into a yellow body named sulphiatic acid. According to the equation—

$$5C_8H_4NOSO_3+K_2Mn_2O_8+3H_2SO_4=$$
$$5C_8H_5NO_2SO_3+K_2SO_4+3H_2O+2MnSO_4$$

It would appear that indigo-red acts upon "permanganate" in the same way as indigotin, whereas indigo-brown is precipitated from its solution in strong H_2SO_4 on diluting, and does not affect the result; but indigo-gluten and the mineral portion strongly decolourise "permanganate." As indigo-red cannot be regarded as an impurity, the inaccuracy in the analysis may be chiefly ascribed to the gluten and mineral impurities. To eliminate this source of error, the author makes use of the property of sodium sulphindigotate, being almost insoluble in solutions of common salt. The 50cc. of the filtered solution of indigo, instead of being directly titrated with permanganate, are mixed in a small flask with 50cc. of water and 32grm. of common salt. The liquid, which is almost saturated with the salt, is allowed to stand for two hours, when it is filtered, and the precipitate washed with about 50cc. of a solution of salt (sp. gr. 1·2). The precipitated sulphindigotate of soda is dissolved in hot water, the solution is cooled, mixed with 1cc. sulphuric acid and diluted to 300cc. The liquid is then titrated with potassium permanganate as before. A small correction is necessary, owing to the slight solubility of the sodium sulphindigotate in the salt solution. For 0·05grm. of the indigo sample 0·0008grm. must be added to the amount of indigotin found.

The potassium ferricyanide method of Allgren is not recommended by the author, the results obtained being too high.

Hyposulphite Method.—This process, which was recommended by A. Müller (*American Chemist*, v. p. 128), depends upon the fact, that a solution of sodium hyposulphite (not *thiosulphate*) reduces sulphindigotic acid quantitatively to disulpho-leucindigotic acid. A flask of 100cc. capacity is loosely filled with twisted sheet zinc, which is covered with a solution of sodium bisulphite (sp. gr. 1·30). The flask is corked and allowed to stand for about an hour. The liquid is now decanted, and well mixed in a large flask or bottle with five litres of distilled water, containing in suspension about 50grm. of recently-slaked lime. The vessel is closed to prevent access of air, and, after allowing insoluble matters to subside, the clear liquid is syphoned off into a convenient stone bottle, and about 100cc. of petroleum oil poured on the surface of the liquid to prevent oxidation. The bottle is fitted with a cork with two tubes, one of which is in the form of a syphon, and is used to fill the burette; the other tube, which only just passes through the cork, is connected with a supply of coal-gas. A further precaution is to cover the bottle with a sheet of black paper. The solution may be standardised either by pure indigotin or by an ammoniacal solution of copper sulphate, using in the latter case indigo-carmine as indicator. The copper solution is prepared by dissolving 1·904grm. (equal to 1grm. indigotin) of the crystallised salt, $CuSO_4.5H_2O$, in a litre of water containing 100cc. strong ammonia (sp. gr. ·880); 50cc. of this solution are measured into a wide-mouthed flask capacity 200cc.) boiled to expel air and allowed to cool. The flask is provided with a caoutchouc stopper, perforated with four holes, into two of which are fitted two Mohr's burettes, one containing the hyposulphite solution, and the other the indigo-carmine. The two other apertures serve for the entrance and exit of a current of hydrogen or coal-gas. The burette containing the "hyposulphite" is furnished with a perforated cork, through which passes a glass tube connected with a supply of coal-gas; and at the lower extremity a glass tube is joined to it, which is in connection with the bottle filled with sodium hyposulphite. By this means the burette can be refilled without fear of oxidising the hyposulphite solution. The flask containing the 50cc. of copper sulphate is attached to the caoutchouc stopper, and the air is expelled by a current of coal-gas, which should first pass through U-tubes containing ferrous hydrate. The solution of "hyposulphite" is now gradually run in until the liquid becomes nearly colourless, when a few drops of indigo-carmine are added from the other burette, and, finally, a further quantity of hyposulphite, until the solution assumes a peculiar brownish-red colour. The quantity of hyposulphite used to decolourise the few drops of indigo-carmine solution is very small, but by determining the strength of the two liquids the amount thus consumed can be easily calculated, and then deducted from the number of cc. of copper sulphate solution. 50cc. of copper sulphate are equivalent to ·05 indigotin, so that supposing 25cc. of sodium hyposulphite have been required for the titration, each cc. of the hyposulphite will correspond to ·002 indigotin. The preparation of the sulphindigotic acid solution is the same as that already given. The measured quantity to be analysed is boiled to expel air and allowed to cool. The flask is then attached to the burettes, and after driving out the air by a current of coal-gas, the hyposulphite solution is gradually added during constant agitation. The advantage of this method is that neither indigo-gluten, indigo-brown, nor indigo-red have any appreciable effect upon the estimation of the indigotin. The only substance which affects the result is iron in the ferric state; but it is only in the lower classes of indigo that iron is present to any appreciable extent, and in those cases it exists, or is subsequently reduced to the ferrous state.

II. *Sublimation.*—The method proposed by C. T. Lee (*Chem. News*, August 1, 1884), *loc. cit.*

According to the author, great accuracy in the results by this method cannot be ensured. He finds that indigo-gluten, indigo-brown, and indigo-red are all more or less affected by this method, and that pure indigotin leaves a residue occasionally amounting to 10 per cent. As a rule, inferior qualities of indigo yield results by this process which are too high, whilst, on the other hand, indigoes rich in indigotin give results undoubtedly too low.

III. *Reduction of Indigotin in an Alkaline Solution.*—Of all these processes the two recommended by the author are that of Crace-Calvert, by means of ferrous sulphate and sodium hydrate, and that introduced by himself, by means of sodium hyposulphite and lime. The latter, he considers, gives the best results of any process hitherto published. This process is as follows: One gramme of finely-powdered indigo is ground into a thin paste with water, and introduced into a flask with 500cc. to 600cc. of lime water. The flask is furnished with an indiarubber stopper, which has four perforations, in one of which is inserted a syphon closed by a pinch-cock, and in another is fixed a funnel provided with a stop-cock; the other two apertures serve for the entrance and exit of a current of coal-gas. The flask is connected with a supply of coal-gas, and the contents heated to about 80° C.; 100cc. to 150cc. of a solution of sodium hyposulphite are now introduced by means of the funnel, and the mixture, which in a few minutes takes a yellow tint, is kept near the boiling point for half-an-hour. After allowing the insoluble matters in the flask to subside, 500cc. are syphoned off, and the remaining liquid accurately measured. The sodium hyposulphite used was five times the strength of the solution previously described. The 500cc. are poured into a flask, and by means of an aspirator a current of air is drawn through the liquid for about twenty minutes. The excess of hyposulphite is thus oxidised to sulphite, and the indigo-white to indigo-blue. An excess of hydrochloric acid is now added to dissolve any carbonate of lime which the precipitate may contain. The precipitate is washed upon a weighed filter with hot water, dried at 100°, and weighed. The weight thus obtained is indigotin and indigo-red. If it is desired to determine the amount of each of these, the filter with its contents is placed in an extraction apparatus, and the indigo-red dissolved by means of alcohol.—J. B. C.

Valuation of Indigo. Ch. Rawson. Jour. Soc. Dyers and Colourists, 1885, 211.

THE author criticises a paper by Dr. Rau (*Amer. Chem. J.* 1885, p. 7) on a modification of Fritzsche's method for the determination of indigo according to which the sample of indigo is reduced by grape sugar and sodium hydrate in an aqueous alcoholic solution. As the author was led to expect from the solubility of indigo-red in alcohol, the reduced indigo when decanted and precipitated by a current of air consists of pure indigotin, indigo-red remaining in solution. The estimation of indigotin is not in itself sufficient to determine the value of a sample of indigo.—J. B. C.

Condensation of Chloral-hydrate with Tertiary Amines. P. Boessneck. Ber. 18, 1516.

THE author has repeated the researches of E. and O. Fischer on the condensation of chloral with dimethylaniline, with the following results. The condensation was effected in presence of $ZnCl_2$, the product dissolved in dilute HCl, and the bases separated with ammonia. The condensation products which become semi-solid upon standing are treated with ether, which dissolves dimethylaniline and another base to be referred to, whereas the methyl derivative of pentaphenylethane discovered by O. Fischer remains undissolved.

The ethereal solution containing the new base is evaporated, and the oily residue treated with steam to eliminate the free dimethylaniline. A black half-solid substance remains, which with an excess of HCl changes to a crystalline mass—the hydrochloride of the base. By filtration and washing with alcohol the crystals are obtained colourless, and by recrystallisation from water, chemically pure, about 25 per cent. of the hydrochloride is obtained on the original quantity of chloralhydrate. The free base separates on addition of alkalis in an oily form; but rapidly becomes crystalline (m. p. 111°). By heating with alkalis, the smell of chloroform is at once apparent. From this fact and the results of analysis the substance is supposed to possess the following constitutional formula: $Cl_3\equiv C-C.OH.H.C_6H_4N(CH_3)_2$, to which the author gives the name of dimethylamidophenyl-oxy-trichlorethane. Further experiments have shown that by modifying the method of preparation—*i.e.*, by allowing the action to proceed in the cold, the formation of the pentaphenylethane derivatives is avoided, and a larger yield of the new base obtained.

As observed, the action of boiling alkalis produce decomposition with formation of chloroform. If the operation be conducted in a flask connected with a condenser, and steam passed into the alkaline liquid, chloroform is found to collect in the receiver, at the same time a colourless substance distils and crystallises in the condenser. From the melting point and properties the authors consider it to be dimethylamidobenzaldehyde, decomposition occurring as follows:

$$(CH_3)_2N-C_6H_4.OH.HC-C\equiv Cl_3+H_2O$$

$$=CHCl_3+C_6H_4N(CH_3)_2.COH+H_2O.$$

—J. B. C.

Reduction Products of the Nitroazo Compounds and Azonitrolic Acids. T. v. Janovsky. Monatsh. Chem. 1885, 455.

THE present paper is a continuation of former researches (this Journal, 1885, 397), with a view to fixing the constitution of the nitrolic acids derived from nitroazo bodies. From the analysis two formulæ are possible—

$$C_6H_5N=NC_6H_4N(OH)-(HO)NC_6H_4N=NC_6H_5 \text{ and}$$

$$C_6H_5N=NC_6H_3-NOH.$$

The position of the group $-N.OH$ is determined by that of the nitro-group in the original substance. On reduction the nitrolic acid gives an amidoazobenzene identical with that obtained from diazoamidobenzene. The red oil obtained as by-product in the preparation of nitroazobenzene is dimetadinitroazobenzene yielding on reduction *m*-phenylenediamine.

By partial reduction of *m*-dinitroazobenzene, a semi-solid nitrolic acid is formed, which dissolves in alkalis on heating with a violet blue colour. The analysis indicates the presence of only one "nitrol" group. If the boiling alcoholic solution be reduced with ammonium sulphhydrate until alkalis no longer give a blue colouration, but a deep green, the solution has a gold-brown colour, the product formed being *m*-diamidoazobenzene—

$$NH_2C_6H_4N=NC_6H_4NH_2(NH_2:N=1:3).$$

This compound is therefore a symmetrical isomeride of chrysoidine. It dyes wool and silk a yellow colour. By nitrating the red oil with excess of fuming nitric acid two nitro-products are formed, one being soluble, the other insoluble in glacial acetic acid.

By partial reduction of *p*-dinitroazobenzene a nitronitrolic acid is obtained (this Journal, 1885, 397), which on further reduction with ammonium sulphide in alcoholic solution yields di-*p*-diamidoazobenzene. This is not identical with diphenin (di-*p*-amidohydrazobenzene. Nitrate of silver added to a solution of a salt of this base gives a yellow-brown precipitate, which dissolves in hot water and crystallises out on cooling. This silver reaction appears to be common to all amidoazobenzenes. This body colours silk yellow, and is the second isomeride of chrysoidine, having the formula—

$$NH_2C_6H_4N=NC_6H_4.NH_2(N:NH_2=1:4).$$

With cold fuming nitric acid, mononitroazobenzene yields a trinitro product (m. p. 180°), and the same compound may be prepared from azobenzene and *p*-dinitroazobenzene. A second trinitro compound is obtained by acting on *p*-dinitroazobenzene in the cold with fuming nitric acid (m. p. 169°), which explodes on heating above its melting point. The formulæ of these two bodies will probably be, $NO_2C_6H_3=NC_6H_3(NO_2)_2\,(3:4)$ and

$$NO_2C_6H_3=NC_6H_3(NO_2)_2\,(2:4)$$

By decomposition *p*-phenylenediamine and triamidobenzene are formed. Trinitroazobenzene gives a nitrolic acid on reduction. These nitrolic acids are fundamentally different from those of the fatty series, and also differ from the hydroxamic and hydroxamic acids, which are prepared with hydroxylamine. The name nitrolic acid has been retained on account of the group .N.OH which is present. From these considerations, and from the fact that the analyses of these compounds indicate a quantity of hydrogen less than that required in the first formula given, the author considers the following to represent the constitution of this class of bodies, $C_6H_5N=\overset{1}{N}C_6H_3=\overset{3\,4}{N}.OH$.—J. B. C.

Improvements in Producing Yellow Colouring Matter suitable for Dyeing and Printing. W. W. Grieve, Glasgow. From the "Farbenfabriken vormals Friedrich Bayer & Co.," Elberfeld, Germany. Eng. Pat. 9606, July 1, 1884.

THIS invention is a development of the specification, 9162, June 19, 1884, and consists in substituting tetrazoditolyl or tetrazodixylyl for the tetrazodiphenyl described in the previous provisional specification. The tolyl and xylyl bases are prepared from nitrotoluene or nitroxylene by a process analogous to that employed in making benzidine from nitrobenzene. The colouring matter is produced by combining the tetrazo-compounds with salicylic acid.—R. M.

Improvements in the Preparation of Purple Colouring Matter suitable for Dyeing and Printing. J. H. Johnson, Lincolns' Inn Fields. From H. Caro, Mannheim, Germany. Eng. Pat. 11,030, August 7, 1884.

THIS invention is an improvement upon the patent No. 4428, September 15, 1883, in which it was stated that zinc chloride was inferior to aluminium chloride as a condensing agent in effecting condensation between carbon oxychloride and dimethylaniline or analogous tertiary bases. The inventor now shows that by a modification of the original process zinc chloride can be equally well employed, and as an example the following method of preparing crystallised methyl purple is given; 100 parts of dimethylaniline are mixed with 18 to 20 parts of phosgene (introduced in the gaseous state) at a temperature of 20° C. The supply of $COCl_2$ must be regulated so as to keep the temperature below 30° C., and the mixture when complete is allowed to stand at the ordinary temperature for about twenty-four hours. Fifty parts of dimethylaniline and 30 parts of dry powdered zinc chloride are then added and the mixture kept well agitated, while phosgene gas is gradually passed in at a temperature of 40° to 50° C. till the mixture has increased in weight by about 20 parts, after which the temperature is maintained at about 50° C. for about six hours, by which time the production of the colouring matter is completed. The present process differs from the original in the use of a different condensing agent and in being carried out in two stages. —R. M.

Improvements in the Manufacture of Colouring Matters Suitable for Dyeing and Printing from Tetramethyldiamidobenzophenone and Analogous Ketone Bases. J. H. Johnson, Lincolns' Inn Fields. From H. Caro, Mannheim, Germany. Eng. Pat. 11,159, August 11, 1884.

This invention is a further development of the process formerly described by the author for the preparation of triphenylmethane derivatives from tetramethyldiamidobenzophenone and analogous ketone bases (Patents No. 4850, March 13, 1884; No. 5038, March 18, 1884; No. 5512, March 26, 1884; and No. 5741, March 31, 1884). In the former patents carbon oxychloride is specially mentioned as a suitable reagent for converting the ketone bases into their haloid derivatives, and the inventor now points out that certain derivatives of carbon oxychloride obtained by chlorinating the chlorocarbonic ethers can be used in a similar manner to carbon oxychloride. The chlorocarbonic ethers are prepared according to the usual method by the action of the alcohols upon carbon oxychloride, and the chlorine derivatives are obtained by passing dry chlorine into the ethers as long as the gas is readily absorbed, the reaction requiring moderation by cooling at the commencement and assisting by heat towards the end. The most active reagent is the chlorine derivative of methyl chlorocarbonate and the activity of the compounds decrease with the increase of molecular weight—*i.e.*, as the homologous series is ascended. The preparation of colouring matters is carried out in a similar manner to that described in the previous patents, and the specification contains examples showing the application of the process to the production of the various colouring matters from the chlorine derivatives of tetramethyldiamidobenzophenone when condensed with secondary and tertiary amines and quinoline.—R. M.

Process or Processes for the Production of Soluble Combinations of certain Azo-Compounds with Bisulphites, and for utilising the same in Dyeing and Printing. H. J. Haddan, 67, Strand, Westminster. From Eugen Frank and the "Farbenfabriken vorm. F. Bayer & Co.," Elberfeld. Eng. Pat. 2206, February 17, 1885.

The azo compounds referred to are:—(1) Diazoazobenzene and its homologues; (2) Benzidine and its homologues (diazotised); (3) α- and β-diazonaphthalene with the two β-naphtholmonosulphonic acids; (4) Diazoazobenzenemonosulphonic acid and its homologues with α- and β-naphthol. On treating the foregoing compounds in a finely-divided state with acid sulphites in hot aqueous or alcoholic solution they dissolve and become soluble in water with a yellow colour. By the action of alkalis or heat these double compounds are decomposed into their constituents, so that cotton or any other fibre can be dyed or printed by first applying the soluble compound and then steaming or boiling.—R. M.

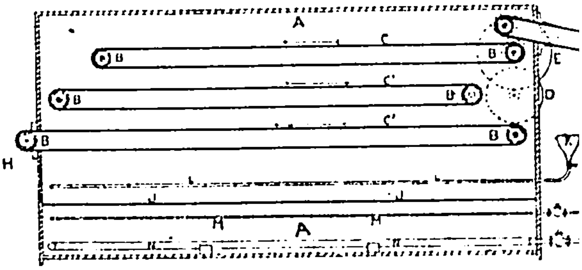
V.—TEXTILES: COTTON, WOOL, SILK, Etc.

An Improved Method of treating Wood and Vegetable Fibres for the Manufacture of Textile Fabrics. Alexander Wilkinson. Eng. Pat. 10,194, July 15, 1884.

Certain methods of bleaching are proposed as substitutes for the usual ones.—E. J. B.

Improvements in the Method of and Apparatus for Neutralising the Acid in Extract Fibre. Samuel Law. Eng. Pat. 10,400, July 21, 1884.

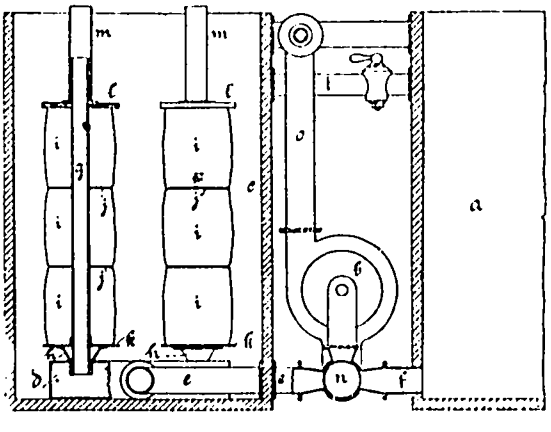
This invention relates to certain improvements in apparatus for neutralising the acid contained in wool, silk, or other animal fibre, after it has undergone the operation of carbonisation for removing vegetable matter. The material passes by means of the endless apron F into the rectangular chamber A. It then drops on to the sheet C, and is carried forward to the other end where it drops on to C^1. From thence it is carried forward and again dropped on to C^2, by which it passes to a hopper placed at H. J is a perforated shelf, below which are the steam pipes M and N, M being perforated. Solution of ammonia is supplied by means of the funnel K and perforated pipe L.—E. J. B.



A New or Improved Apparatus for, and Method of Chemically treating Wool, Cotton and other Soft Goods. Lorentz Albert Groth. From Henry Giesler. Eng. Pat. 10,439, July 22, 1884.

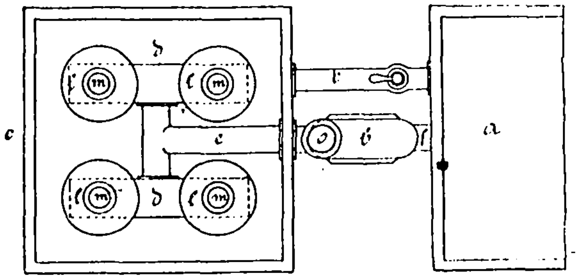
The apparatus is shown in Figs. 1 and 2. The material to be treated, in the form of slubbing, rovings or slivers, is wound in coils round the perforated pipe *g*, the coils being separated from each other by discs *j*. The liquid contained in the reservoir *a* runs by the pipe *f*, through the cock *n*, the pipes *c* and *d*, and the perforated pipe *g*, through the material into the vessel c. As soon as a proper level is obtained, the pump C is set in motion, and the

FIG. 1.



liquid is drawn back through the material, and returns by way of the pipe *o* into the reservoir *a*. The specification contains other drawings showing slight unimportant modifications of the above.—E. J. B.

FIG. 2.



Improvements in the Manufacture of Fibrous Material from Wood for Surgical and other Purposes. Henry Harris Lake. From Josef Odelga. Eng. Pat. 2987, March 6, 1885.

The inventor claims the preparation and use of the long thread fibrous material obtained by scraping strips or blocks of wood, which material is similar to linen lint, and may be used as lint for surgical purposes, or as filling material, and may be spun into yarn, and in the form of spun yarn be used in the manufacture of woven fabrics, cord, braided articles, netting, embroidery, and knitted goods.
—E. J. B.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

Note on Printing Blue Grounds. M. O. Breuer. Bull. Mulhouse, p. 532, 1884.

Difficulties experienced in printing blue grounds with Alkali blue 5B. have suggested the method described, which was successfully used for years for printing violet. The addition of 15 per cent. of ammonia caused complaints respecting uneven grounds to cease. The blue made with Alkali blue 5B., and treated in this manner, was in itself an improvement, but perfection was only attained by proceeding as follows:—The blue 5B. was first decomposed by an acid, and dissolved in ammonia. The following are the formulæ:—

For the blue—

Alkali blue 5B.	1,000	grams.
Water..........................	10,000	,,

Dissolve and precipitate with—
100 grams of HCl at 21° Bé., decant and filter:
The result is 10,000 grams of blue paste.

Printing colour—

Blue paste as above	2,000	grams.
Ammonia	350	,,
Glycerine	500	,,
Dry gum senegal............	1,100	,,

Reduction—

Gum water	1,000	grams.
Ammonia	35	,,
Glycerine	75	,,

Print on wool mordanted with tin, damp before steaming, steam 60 minutes and wash. These remarks bear out a fact known some time already, and which perhaps might repay study—viz., that the addition of ammonia improves all printing colours made with aniline colours properly so called, as well as those popularly so called. Almost all are improved thereby, even those which ought not to be affected at all, such as, *e.g.*, the ponceaux R, 2 R, and 3 R, which are all salts and not acids. It has also been noticed that in printing light blue grounds on silk, the addition of ammonia to aniline colours has been of another advantage. It was found thereby possible to avoid the presence in light blue grounds of little light and sometimes even white spots with which previously the grounds were sown, and which were simply due to calcareous soap, resulting from careless soaping. Ammonia proved to be a solvent for the substances producing these marks.—H. A. R.

Chrome Discharge of Indigo Blue. A. Scheurer. Bull. Mulhouse, 1885, 316.

The process of fixing an alumina mordant simultaneously with the discharge of a dyed indigo blue, by means of a mixture of aluminium chloride and potassium bichromate, printed upon the cloth and steamed, is attended with the disadvantage that in the after-process of dyeing with alizarin the shades produced are lacking in brightness. Better results are obtained by substituting aluminium oxalate for the chloride, in which case an acid (oxalic) requires to be added. In comparing the alizarin shade produced upon an original and a discharged white (indigo), each of which had been printed with this mixture and steamed, those upon the former were found to be considerably brighter. A probable explanation of the inferior colour upon the discharged ground is the retention of a chromic oxide in combination with a product of oxidation of the (discharged) indigo.—C. F. C.

Use of Oxalate of Antimony in Printing. E. Jacquet. Bull. Mulhouse, 1885, 318.

The author recommends a mixture of basic antimony oxalate and ammonium oxalate as a substitute for tartar emetic in the fixation of tannin, and, therefore, of those colours which require the tannin mordant—*e.g.*, methylene blue. The basic salt is prepared from the antimony-potassium oxalate by precipitation with ammonia, and is added in the form of paste together with twice its weight of ammonium oxalate, to the mixture of colouring matter, tannin, etc., in the usual proportions. After steaming the goods are cleared in the usual way, but with the addition of chalk to the bath in order to neutralise the oxalic acid.—C. F. C.

Development of Aniline Black. C. Zurcher. Bull. Mulhouse, 1885, 319.

The tardy development of aniline black upon the fabric from the usual printing mixtures, at temperatures between - 13° and + 13°, the author refers to a separation of the aniline salt from the liquor, which appears from his observations to be especially favoured by certain conditions of humidity and of movement of the surrounding atmosphere.—C. F. C.

Starch as a Substitute for China Clay in Printing. O. Breuer. Bull. Mulhouse, 1885, 322.

The author finds that starch, made into a paste with water in the cold, is a perfect substitute for China clay for printing in reserve for indigo blue, and for many other purposes, especially for printing upon silk. It may be used in quantities of from 250 to 400 grammes per litre of thickening, without causing any undue hardening of the fabric.—C. F. C.

A Reducing Vat for Indigo and Blue-Black. C. Collin and L. Benoist. Ger. Pat. 30,449, Feb. 29, 1884.

In order to avoid detrimental fermentations in preparing the vat, the inventors propose to employ a completely fermentescible food material, and a pure ferment. For a vat of 8000 litres, 16kilos. of flour or starch are boiled for a few minutes in water containing 1·6kilo. of sodium carbonate. The starch paste is transferred to the vat, and 8kilos. of glucose, 5·38kilos. of soda, and 1kilo. of magnesia are added. Magnesia is better adapted for the neutralisation of the lactic butyric and other acids formed than lime. With this vat, the amount of alkali necessary to combine with the above-named acids and to form the indigotic salt may be calculated with fair accuracy. As, however, the alkalinity

of the vat at the commencement would be too high if the total amount of alkali were to be added at once, there is added upon the first day only one half of the soda required to neutralise the acids formed, in addition, of course, to the alkali required for the formation of the indigotic salt. This is calculated to be 230grm. of soda for 1kilo. of indigo. Whilst the vat is being worked, an addition of 2kilos. of starch paste and 2kilos. of glucose (daily) will suffice for 100kilos. of wool dyed per diem. With pure indigo, this method gives 40 per cent. better results, with mixed indigo and blue-black 65 per cent. better results, than the old reduction plan. The ferment, *desmobacterium hydrogeniferum*, is obtained pure by the following cultivation process:—100grm. of potato cuttings are allowed to digest for some time in 500cc. of water, at 40° to 44° C. The liquid soon becomes peopled with micro-organisms, amongst which is the desmobacterium. A flask is now filled with 1·5grm. phosphate of soda, 3grm. tartrate of ammonia, 5grm. of glucose, 5grm. of soluble starch, 3grm. of sodium carbonate, 0·5 grm. of lime, and 1litre of water. The flask is provided with a doubly-bent tube, which dips into a large evaporating basin containing 200cc. of water. The contents of the flask and basin are boiled for twenty minutes to effect sterilisation, and also to expel air, and then 50 to 60cc. of the liquid containing the desmobacteria are introduced into the basin, the boiling being at the same moment discontinued. The contents of the basin are slowly sucked into the flask, and when this has cooled down sufficiently for the hand to touch it without inconvenience, the bent tube is dipped under mercury, and the whole maintained for four or five days at a temperature of 38° to 40° C. At the end of this period, the desmobacterium will be in full activity, and in a pure condition; the liquid is then to be absorbed by wood flour sterilised at 150° in the proportion of three parts of the flour to two of liquid. The moist wood flour is dried at 40° to 45°, and the ferment thus obtained preserved in well-closed bottles. Of this prepared ferment, 50grm. suffice for a vat of 12cbm. contents.
—W. D. B.

Improved Apparatus for Dyeing. W. D. Thornton, Bradford. Eng. Pat. 10,042, July 11, 1884.

The object of this invention is to dye wool in the sliver, loose, and also when spun into yarn; also cotton in various stages of manufacture, in less time than hitherto. The fibres to be dyed are placed in an air-tight vessel, a vacuum is created inside the vessel, and the dye-liquor admitted by opening a valve. Owing to the vacuum previously present, penetration is rapidly completed, and the dyeing rendered uniform. The liquor is finally drawn off by an ejector, which can be done in much less time than possible by gravity alone.
—H. A. R.

Improvements in the Application of Chloride of Lime for Bleaching Purposes. George Lunge, Zürich. Eng. Pat. 11,333, August 16, 1884.

Hydrochloric, sulphuric or oxalic acids, when used as a means of liberating chlorine, do so as free chlorine, which injures fibres, machinery and health of workmen. Carbonic acid liberates hypochlorous acids instead of free Cl, but its gaseous form is not convenient. It is proposed to employ acetic acid, or another weak organic acid of an analogous nature. A very small quantity is sufficient, as it acts over and over again. The reactions taking place are the following:—

(1) $2(CaOCl_2)+2(C_2H_4O_2)=Ca(C_2H_3O_2)_2+CaCl_2+(HOCl$
(2) $2(HOCl)=2(HCl)+O_2$
(3) $Ca(C_2H_3O_2)_2+2(HCl)=CaCl_2+2(C_2H_4O_2)$.

No free acid is thus ever present, which is a great advantage, especially with short fabrics. The acetic acid may be either added to the bleaching liquor at first, or the acid used along with the bath subsequent to soaking in bleach liquor. It is claimed that less bleaching powder is required, and that the water courses are less fouled.—H. A. R.

Improvements in Dyeing Cotton Yarns and Fabrics. F. A. Gatty, Accrington. Eng. Pat. 11,456, August 20, 1884.

This invention consists in an improved method of dyeing certain fast and permanent colours from olive to brown, by means of the oxides of chromium and iron in varying proportions, according to the shade required. For an olive shade, the inventor takes five gallons of chrome alum solution at 10° Tw., and 1 gallon of $FeSO_4$ at 1¼lb. per gallon, or else an equivalent quantity of another soluble iron salt. For brown, the quantity of iron is increased according to shade, and the goods are then squeezed in a suitable manner. The next process is a passage through soda solution at 4° Tw. or more, and at a temperature of 140° to 150° F. approximately. The subsequent treatment of the dyed goods presents nothing unusual.—H. A. R.

VII.—ACIDS, ALKALIS, AND SALTS.

Preparation of Stannic Chloride. L. A. Czimatis (Ger. Pat. 31,550, October 22, 1884). Dingl. Polyt. J. **256**, 332.

On heating a mixture of stannic oxide and magnesium chloride, or calcium chloride, stannic chloride distils over, and may be condensed. The mass obtained by mixing a solution of stannic oxide in hydrochloric acid with the chloride of an alkali metal, or of an alkaline earthy metal, after evaporation, can be similarly treated.—J. T.

Combination of Oxalic Acid with Alumina. C. Koechlin and L. Mathieu-Plessy. Bull. Mulhouse, 1885, 304.

Oxalic acid in combination with alumina is not immediately precipitated by lime salts. The authors have endeavoured, but without success, to take advantage of this property in the employment of the latter as mordants. Their researches, however, established the following relationships of affinity:—(1) Tribasic aluminic sulphate (hydrated) dissolves in a solution of neutral ammonium oxalate; (2) hydrated aluminic oxide likewise; (3) cryolite is attacked by a solution of oxalic acid at high temperature (150°).—C. F. C.

Use of Koerting's Apparatus for Facilitating the Passage of Gases from Pyrites Burners to the Lead Chambers. A. Scheurer-Kestner. Bull. Mulhouse, 1885, 348. (Sealed Packet, October, 1877.)

The author's experiments on this subject commenced at Thann in 1876. After many modifications, a thoroughly satisfactory and economical arrangement of the apparatus has been devised, whereby the steam to supply the lead chambers is intercepted and caused to work the blower. It is found that the steam from 1814kg. water, employed in this way, will produce sufficient draught for the combustion of 7000kg. pyrites of 45 per cent. sulphur.—C. F. C.

The Italian Tartar Industry. G. Kaemmer. Chem. Zeit. 9, 939 and 1012.

The greater proportion of the Italian tartar is obtained from the marc and lees, and sold as half-refined. Cream of tartar is manufactured in Italy, to a very small extent in the south, but somewhat more largely in Piedmont, Tuscany, Lombardy, and generally speaking Upper Italy. The manufacture of tartar—Cremore di St. Antimo—is carried on largely in the south, and has concentrated around St. Antimo, Trani, Barri, and Messina. The lees are collected in the provinces, dried on the spot, and forwarded home, where they are ground in common horizontal mills, boiled in copper boilers, holding about 1200 litres, with from 10 to 12 times their weight of water, and the whole allowed to stand for 5 or 6 days, taking care to prevent the crystals which form at the surface from falling to the bottom. The liquor and crystals are removed from the insoluble portion, and this is boiled with sulphuric or hydrochloric acid, and potash added subsequently in a thoroughly empirical manner, to effect the conversion of the tartrate of lime into acid tartrate of potash. This second crop of bitartrate is of less purity than that obtained by the first crystallisation, and is mixed therewith. The costs of working, owing to the crudeness of the apparatus, are very small, about 28-34 marks per 100kilos. of tartar. The loss of tartaric acid varies from 8 to 15 per cent., and the above estimate of the cost takes no account of the price of the lees. Well-arranged factories, working with a loss of 4 to 6 per cent. at most, and turning the nitrogenous residues to account, are able to manufacture a better product at a cost of 8 to 12 marks per 100kilos. of tartar. The importance of the Italian tartar industry is seen from the fact that in Southern Italy alone the number of boilers amounts to between 3000 and 3500, corresponding to a production annually of 6,000, 000kilos. of tartar from lees that is more than 10,000,000 marks. The composition of this tartar is upon an average:—

69·87 per cent. tartaric acid as potassium bitartrate
4·06 ,, ,, ,, as calcium tartrate

Total, 73·93 ,, ,, ,, corresponding to
94·60 ,, of its salts

The remaining 5·4 per cent. consists of moisture, organic matter, sand (as much as 1 per cent.), iron, alumina, copper, phosphates, and magnesia. The manufacture of Cremore di Vinaccia, directly from the marc of the red grape, is carried on in a more scientific manner and with greater profit than that of Cremore di St. Antimo, since the alcohol obtained is a considerable source of profit. The author estimates the total annual value of this product at 5,000,000 marks, and places the average composition as 60 to 72 per cent. of tartaric acid as potassium bitartrate, 3 to 10 per cent. as tartrate of lime, recent analyses having shown 85·01 per cent of bitartrate, 7·81 of calcium tartrate. The remainder consists for the most part of moisture, sand and organic matters; of iron, phosphates, copper, and alumina, there are less than in the Cremore di St. Antimo. The method of testing, almost universal still for trade purposes, consists in boiling 50grm. of the finely-powdered sample with one litre of water for 6 to 10 minutes, pouring the clear solution into a dish and allowing it to remain at rest for 12 hours. The crystals are then collected, dried and weighed; the weight found multiplied 2 and increased by 10 to correct for solubility, is taken as the percentage of potassium bitartrate. Cremore di St. Antimo is sold upon a basis of 90 per cent., Cremore di Vinaccia upon that of 85 per cent. The manufacture of cream of tartar or refined tartar is not carried on upon a large scale as compared with that of crude tartar. The total production can scarcely be more than 600,000kilos. with a value of 1,500,000 marks; the export is almost exclusively to England. The production of tartaric acid is much hampered by the high price of sulphuric and hydrochloric acids, but amounts to between 200,000 and 250,000kilos. per annum of about three-quarter million marks in value. The greater proportion of this is consumed at home, the remainder exported to England. It is computed that the total value of the Italian wine residues amounts to between 26 and 30 million marks per annum, or 1 mark per hectolitre of wine; by improved methods of working this amount might readily be increased by one-half or even doubled.—W. D. B.

New Applications of the Nitrometer. G. Lunge. Chem. Ind. 8, 161-171.

The author at first criticises Allen's paper on the same subject, read before the Birmingham Section of this Society on 4th March, 1885. According to Allen, sulphuric acid has "a notable solvent power for nitric oxide," and hence a source of error is introduced, which must not be ignored, but Lunge proves this statement to be wrong (*Ber.* 18, 1391). He also points out here that the nitrometer is an excellent contrivance for determining the solubility of gases in certain liquids under variable pressure and temperature. Another new application of the same apparatus is for reducing volumes of gas to normal pressure and temperature.. Lunge also modified Allen's apparatus for the estimation of urea in urine. A small 50cc. beaker fitted with a perforated indiarubber cork is connected by a small piece of strong indiarubber tubing with the nose of the three-way tap of the nitrometer, which is filled with mercury (Allen fills his instrument with a saturated solution of sodium or magnesium sulphate). The beaker, which should be of strong glass, contains a small glass or ebonite tube, provided with a loop of platinum wire (*Fig.* 1) to facilitate its insertion and withdrawal. Or, better still, the beaker may be replaced by a small bottle, containing a tube fused to the bottom (Fig. 2). The whole must be light enough to be hung on the nitrometer-tap. The same apparatus can, of course, take the place of Knop's azotometer, Scheibler's carbonic acid apparatus, or be used for the assay of commercial peroxide of hydrogen. In the latter case the sample to be tested is filled into the inner tube, while permanganate solution, strongly acidified with sulphuric acid, is placed into the bottle proper. On mixing, oxygen is readily given off, and the quantity of the same is measured in the nitrometer. A very interesting and novel application depending on the same principle and the same reaction is for titrating standard solutions without weighing or measuring a substance of known composition. Supposing a potassium permanganate solution has to be tested for its strength. A certain measured quantity of permanganate is acidified with sulphuric acid, and decomposed with an excess of hydrogen peroxide of unknown strength. The complete decolourisation shows whether an excess was present. If now the volume of oxygen given off be measured in the nitrometer the strength of the permanganate solution can be easily

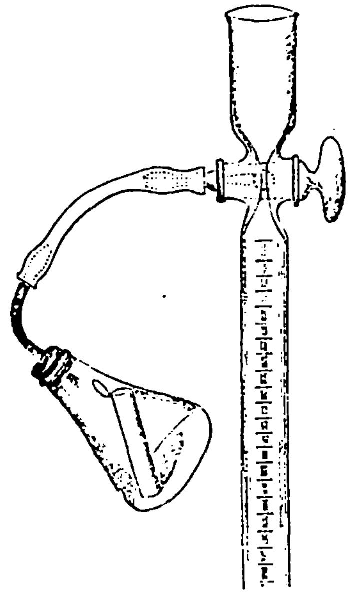


FIG. 1.

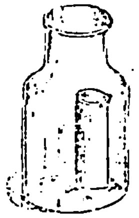


FIG. 2.

calculated. It is shown by experiments that this method is very accurate as well as quick. For testing the strength of standard acids (sulphuric, hydrochloric acid, etc.), a measured quantity is treated with an excess of sodium or calcium carbonate, and after reading off the volume of carbonic acid evolved, the strength of the acids can be computed. These examples can be increased by many more. Suffice it to say, that the nitrometer may be used for analytical purposes in all cases where a certain quantity of gas is produced, which after measuring allows of the decomposed substance being calculated. Of course, the gas must not be soluble in the liquid employed for decomposing, nor must it attack mercury. Bleaching powder solution acts on the hydrogen peroxide like permanganate. By means of bleaching powder solution in excess, the strength of hydrogen peroxide can therefore be estimated, and *vice versâ*. Potassium ferricyanide in alkaline solution liberates the oxygen of peroxide of hydrogen, and can therefore be analysed in the same manner. The nitrometer can further serve in analytical operations for absorbing gases. The determination of indigotin and indigo-red in commercial indigo by reduction to indigo-white and measuring the amount of oxygen absorbed, belongs to this class of operations. Another very convenient application is for absorbing gases evolved in manufacturing processes, because of the nitrometer combining the advantages of Bunte's and Hempel's gas burettes with the possibility of manipulating the gases over mercury. If it be required to test fire-gases for carbonic dioxide and oxygen, which is all that is necessary in most cases, the gases are aspirated into the nitrometer-tube, and after cutting off the further supply of the gases, potassium hydrate solution is introduced through the cup into the measuring tube. After shaking, the percentage of carbonic dioxide can be read off. Then some concentrated pyrogallic acid solution is added, and the oxygen estimated. If analyses of gases have to be performed where reagents must be applied which act on each other, the nitrometer is combined with several of Hempel's gas-pipettes. For the analysis of gases dissolved in water, etc., the small beaker in Fig. 1 is filled with the liquid in question, and after inserting the stopper the liquid is raised to the boil, and the heating continued until all gases are driven out. By lowering the reservoir tube the expulsion of gases is greatly facilitated by suction. When the volume does no more increase, the beaker is disconnected by turning the tap, the nitrometer allowed to cool, and the gases are ready for being analysed.—S. H.

On the Inflammability of Vegetable Matter by Nitric Acid. R. Hass. Chem. Ind. **8**, 173.

A CARBOY filled with common nitric acid, 36° B. (1·325), strong, and packed up in the usual manner in a wicker basket with straw, was said to have taken fire spontaneously. The author, therefore, made some experiments in order to find out up to what lowest strength nitric acid is liable to cause spontaneous combustion. The above table renders the details and results of these experiments.—S. H.

No. of Experiment.	Concentration of Nitric Acid.		Packing Material consisting of	Box or Wicker Basket.	Size of the same: Cubic contents.	Time from the moment of wetting packing material with the acid until it took fire.
	°B.	Sp. gr. at 17° C.				
1.	41	1·388	Rough straw.	Wooden box.	3 Litres.	45 minutes.
2.	41	1·388	Sea-weed.	"	"	35 "
3.	36	1·325	Hay.	"	12 Litres.	40 "
4.	36	1·325	Rough straw.	"	"	50 "
5.	35	1·313	Hay.	"	"	36 "
6.	35	1·313	Rough straw.	"	15 Litres.	2¼ hours.
7.	34	1·301	"	"	12 "	Strong evolution of vapours, but no flame.
8.	33	1·290	"	Wicker basket.	20 "	
9.	33	1·290	Fine straw.	Box.	15 "	1¾ hour.
10.	32	1·279	Hay.	"	12 "	15 minutes.
11.	32	1·279	Fine straw.	"	15 "	3¼ hours.
12.	31	1·268	Hay.	"	15 "	1 hour.
13.	31	1·268	"	Basket.	20 "	55 minutes.
14.	31	1·268	Fine straw.	Box.	15 "	Strong evolution of vapours, but no flame.
15.	31	1·268	"	Basket.	20 "	
16.	30	1·257	Hay.	Box.	20 "	1¼ hour.
17.	30	1·257	Rough straw.	Basket.	20 "	Strong heat; no flame.
18.	29	1·276	Hay.	Box.	15 "	2¼ hours.
19.	29	1·276	Fine straw.	"	12 "	Strong evolution of vapours, but no flame.
20.	29	1·276	"	Basket.	20 "	
21.	28	1·236	Hay.	Box.	12 "	
22.	28	1·236	"	"	15 "	
23.	28	1·236		Basket.	20 "	

On the Limit of Combination between the Bicarbonates of Magnesium and Potassium. R. Engel. Compt. Rend. **100**, 1224-1227.

FROM previous experiments of the author, potassium and magnesium bicarbonate combine to form sesquicarbonate

$MgCO_3.HRCO_3+4H_2O$, with elimination of CO_2. He has further determined the condition of equilibrium by the mutual action of the bicarbonates—(1) under different pressures of CO_2 (by which the magnesium carbonate is held in solution); (2) under equal pressure, but varying proportions of the two bicarbonates. The experiments show from (1) the decomposition of the double salt at equal temperatures increases with the pressure of CO_2; and from (2), the relation $y = \sqrt{2a-x}$ when x and y are respectively the amount of sulphuric acid necessary to neutralise potassium or magnesium carbonate held in 10cc. of the solution, and a a constant (=6·25).—J. B. C.

Determination of the Value of Acetate of Lime. A. A. Blair. Amer. Chem. J. 7, 26-31.

The solution of acetate of lime is precipitated with a weighed quantity of sodium carbonate, and the excess of alkali titrated in an aliquot portion of the filtrate with normal acid, using phenol-phthalein as indicator. If the solution of the acetate is brown in colour, it is filtered through animal charcoal before the addition of the sodium carbonate.—S. R.

Iron Vessel for holding Acids. E. Pohl, Dortmund. Ger. Pat. 30,188, January 3, 1884.

This vessel, which is to serve for the storage and transport of nitric acid, etc., consists of a drum lined with asbestos cloth, made impermeable by soaking in a bath of paraffin, stearin or wax.—F. M.

Method for the Preparation of the Anhydrides of Organic Acids. Chemische Fabrik vormals Hoffmann und Schötensack, Ludwigshafen. Ger. Pat. 29,669, April 9, 1884.

A current of carbonyl-chloride is passed over anhydrous sodium acetate heated to 140°. The distillate is purified by fractional distillation, 15 parts of it yielding about 10 parts of fairly pure acetic anhydride. Particular care must be taken not to heat the sodium acetate beyond 140°, as otherwise considerable quantities of acetone would be formed, which can scarcely be completely separated from the anhydride. Propionic and butyric anhydrides may be prepared in a similar manner, the anhydrous salts, however, requiring a temperature of 170° and 200° respectively, for their decomposition. In both cases chlorides are formed besides the anhydrides, evidently in consequence of a secondary reaction expressed by the equation $(C_3H_7CO)_2O+COCl_2=CO_2+2C_3H_7COCl$. The chlorides are converted into anhydrides by the well-known methods. Benzoic anhydride can likewise be prepared by this method, the sodium benzoate being heated to 360° while exposed to the action of the carbonyl-chloride. The greater part of the product formed in this case consists of benzoyl-chloride.—F. M.

An Improved Process and Apparatus for the Continuous Production of Carbonic Acid. E. Capitaine, London. From H. Herbertz. Eng. Pat. 8617, June 5, 1884.

This improved process comprises the production of carbonic acid free from air as the main product, and of carbonic acid mixed with air as a by-product. Five cylindrical vessels arranged one above the other, provided each with a stirring apparatus, and capable of being heated with steam or by a fire, serve for the reception of the bicarbonate of soda or of potash. The first cylinder is provided with a hopper, by which the finely-ground material is fed in, and the cylinders are connected with each other by tubes at alternate ends, so that the bicarbonate passes along the whole length of the apparatus. The first and fourth cylinders are fitted with domes and gas-escape pipes, by which the carbonic acid is led to cooling worms for the abstraction of its heat and some of its moisture, and then through purifying vessels containing sulphuric acid, and finally to gasometers. The gas from the fourth cylinder is free from air.—W. D. B.

Improvements in the Method of and in Apparatus for Extracting Sulphur and Sulphurous Acid from Pyrites. Arthur Charles Henderson, Middlesex. From Léon Labois, Paris. Eng. Pat. 9761, July 4, 1884.

The arrangements preferred by the patentee for this purpose consist of a retort connected with a condensing chamber and separately heated, placed immediately above a roasting furnace of the Malétra type, in such manner that the heated residue from the former may be immediately raked into the latter through a valved channel temporarily placed against the mouth of the retort. A large percentage of elementary sulphur may be thus distilled off, the residual sulphur being roasted into sulphur dioxide in the second stage and utilised as desired. By a slight modification the ore in the first case charged into and removed from the retort through the door, may be introduced through a hopper placed in its roof, and be raked into the calciner through a cavity in the floor, this channel being effectually closed during distillation by the previous charge. If the situation of the works will not permit of the erection of the distilling furnace immediately above the calciner, the half-treated ore must be conveyed rapidly, while still hot, in a hopper truck from the one furnace to the other. The retort and calciner may be constructed in one, but in order thus to insure satisfactory results the air introduced for the calcination must be heated, preferably by regeneration of the heat from the escaping gases.—W. G. M.

Improvements in the Manufacture of Precipitated Phosphate of Alumina and the Mixed Precipitates of Phosphate of Alumina and Sulphate of Lime. W. A. Hills. Eng. Pat. 10,267, July 17, 1884.

Raw or calcined natural phosphate of alumina is treated with sulphuric acid in the usual way; the resultant solution is separated from the insoluble residue, and the phosphate of alumina is precipitated by diluting the solution with water, preferably hot, or by blowing steam through it until the same result is attained. The inventor finds that sufficient dilution with pure water will cause the precipitation of the alumina salt from the acid solution, but water containing an alkali in solution may also be used if desired, or in some cases chloride of sodium or potassium, or chloride of lime may be added for the purpose of causing a readier precipitation. By the addition of solution of salts of lime produced by the lixiviation of "tank waste," a mixed precipitate of phosphate of alumina and sulphate of lime is obtained. —H. J.

Utilisation of Waste Calcium Chloride. C. T. Richardson. Eng. Pat. 10,418, July 21, 1884.

The process, which is primarily designed to effect the utilisation of the calcium chloride produced as a waste product in the Weldon process, the ammonia-soda process, etc., consists in treating the purified solution with solution of sulphate of ammonia in the proportion requisite for the conversion of the whole of the calcium chloride into sulphate. The precipitated lime salt is then separated by filtration, and the ammonium chloride solution concentrated and crystallised in the usual manner.—H. J.

Improvements in making Granulated Crystalline Carbonate of Soda, and in Apparatus therefor. J. Mactear. Eng. Pat. 10,651, July 28, 1884.

The invention relates to the manufacture of carbonate of soda (soda crystals) in a granulated crystalline form, and is an improvement upon the inventor's patent, No. 1714, of 1875. The process consists essentially in dissolving soda ash in water, and subjecting the solution during crystallisation to the combined action of cooling and scraping or agitation in a long shallow trough having a passage for cooling water beneath it, and provided with a number of scrapers fixed to a frame which receives longitudinal movements from a rotating shaft, and which is lifted during its return movement by bell-cranks operated on by a rotating cam.—H. J.

Improved Process for Obtaining or Recovering Manganese Oxide from Manganese Sulphate produced in obtaining Chlorine. J. Mactear. Eng. Pat. 10,813, July 31, 1884.

A SOLUTION of manganese sulphate is mixed with sufficient magnesium chloride to be equivalent to the sulphate, and to any free sulphuric acid in the solution. The mixture is evaporated out of contact from air, whereupon hydrochloric acid is copiously evolved, and may be condensed and utilised. In this way there is formed a mixture of manganese oxide and magnesium sulphate, from which the latter can be removed by washing with water. The manganese oxide can be subsequently raised to a state of higher oxidation for use in obtaining chlorine. The magnesium sulphate may be crystallised, and sold as such, or it may be reconverted into magnesium chloride for use again in the process.

—S. H.

Improvements in the Manufacture of Chlorine and Hydrochloric Acid. W. Weldon. Eng. Pat. 11,035, August 7, 1884.

THIS invention consists in heating solid hydrated magnesium chloride to a low temperature, so as to drive off a large portion of its water without driving off more than a small part of its chlorine. After having been partially dehydrated, the solid magnesium chloride is intimately mixed with magnesia and the mixture heated in a current of air. The chlorine is thereby driven off, partly in the free state and partly as hydrochloric acid. Instead of partially dehydrating the magnesium chloride before adding magnesia, the latter may be intimately mixed previously. In this case, if it be desired to obtain as much as possible of the chlorine in the free state, the mixture should at first be dehydrated by heating it at a low temperature, and should be then heated to a higher temperature in a current of air.—S. H.

Improvements in Manufacturing Chlorine from Hydrochloric Acid. W. Weldon. Eng. Pat. 11,036, August 7, 1884.

THE invention relates to neutralising with magnesia the hydrochloric acid from which it is desired to manufacture chlorine, and then treating the magnesium chloride so obtained for the separation of free chlorine from it. This is best done by evaporating the solution of magnesium chloride and adding magnesia to it. The solid magnesium oxychloride thus obtained is heated to a low temperature to drive off a portion of its water, and then to a high temperature in a current of air.

—S. H.

Obtaining Large-grained Salt. Brandes, Lippe. Ger. Pat. 31,781, August 26, 1884.

IN order to obtain a larger amount than hitherto of coarse-grained salt from brine, the latter is drawn off as soon as the coarse grains have completely formed, and worked for fine-grained salt in a second pan. Hitherto a portion of the large-grained salt has been allowed to remain in the pans, to be collected subsequently as a second-quality product.—W. D. B.

Improvements in Packages for containing Caustic Soda. J. Clare. Eng. Pat. 12,159, September 9, 1884.

THE improvement consists in the method of closing the orifice in the head of the caustic-soda drum by means of a lid with folded edges, so arranged as to slide within the edges of the orifice, also folded to correspond.

—H. J.

Improvements in the Utilisation of Alkali Waste from the Leblanc Process in the Manufacture of Carbonate of Soda with Production of Sulphuretted Hydrogen. E. W. Parnell and J. Simpson, Liverpool. Eng. Pat. 381, January 12, 1885.

THE object of this invention is to dispense with the use of lime for the liberation of ammonia from ammonium chloride in the ammonia-soda process, by employing alkali waste from the Leblanc process for this purpose, and also to produce sulphuretted hydrogen in a condition available for the manufacture of sulphur or its compounds. A mixture of alkali waste is heated with a solution of ammonium chloride in a closed vessel, when ammonium sulphide will be given off with the steam. This vapour is absorbed in water, and employed for the manufacture of carbonate of soda, by being conducted into a solution of sodium chloride, together with carbonic dioxide, in the same manner as free ammonia is employed in the ordinary manufacture of carbonate of soda by the ammonia process. Ultimately the sulphur which passes into the absorbing plant is liberated in combination with hydrogen, and may, after washing with an acid solution to absorb any trace of ammonia, be burnt or dealt with by any of the known methods.

—S. H.

Improvements in the Manufacture of Chromates and Bichromates. J. J. Hood. Eng. Pat. 3895, March 26, 1885.

THE chrome ore is first heated with potassium salts, and with or without lime, in the usual manner, lixiviated, and the resulting potassium chromate solution concentrated.

In order to produce sodium chromates, the above-described solution is treated with sufficient sulphate of soda to convert all the potassium and calcium salts present into sulphates, and the mixture concentrated, when the potassium sulphate crystallises out, and may be used for decomposing a fresh quantity of ore; the saturated solution of sodium chromate is then treated with the quantity of sulphuric acid necessary to combine with half the sodium present, and the sodium sulphate separated by crystallisation. The solution of sodium bichromate is then further concentrated and crystallised, or evaporated to dryness and fused.

To prepare the ammonium chromates, a hot, strong solution of ammonium sulphate is added to a hot, strong solution of potassium chromate, and the whole allowed to cool, when the bulk of the potassium sulphate formed crystallises out. The residual liquid, which still contains some potassic sulphate, may be used for making either ammonium chromate or bichromate; for the first salt, the liquid is evaporated at a gentle heat, with addition of ammonium hydrate if necessary; during the concentration the potassium sulphate crystallises out and is removed, and the ammonium chromate is eventually allowed to crystallise. To form ammonium bichromate, the liquid is simply boiled down, the potassic sulphate taken out as it separates, and the solution crystallised; the ammonia gas given off during the operation being collected by suitable means.

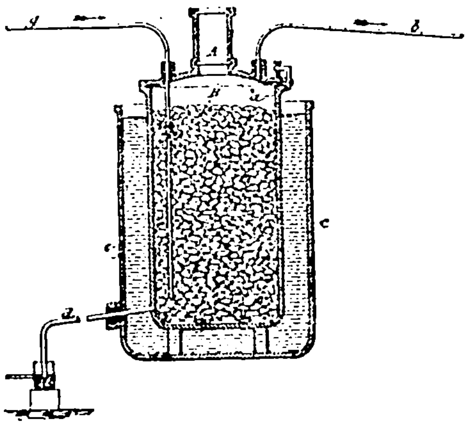
Or the ammonium salts are prepared from sodium chromate, and ammonium sulphate or chloride, with addition of hydrochloric or sulphuric acid in sufficient quantity to form sodium bichromate, whereby losses of ammonia are avoided. Other chromates and bichromates may be prepared from sodium chromate.—H. J.

Improvements in Apparatus for the Production of Sulphuric Acid. William Spence. From J. Thyss, of Baku, Russia. Eng. Pat. 9317, June 23, 1884.

THE apparatus under this invention is intended to increase the production of sulphuric-acid chambers, and consists in the adaptation to such chambers of one or more columns of lead, which support leaden frames and sheets of lead pierced with holes alternately. Sulphurous acid, nitrous gases, and steam pass through the holes of the plates and impinge on the parts not perforated, whereby a multiplied contact is brought about which effects a better oxidation of the sulphurous acid.—S. H.

Improvements in the Manufacture of Anhydrous Sulphuric Acid. Henry Edward Newton. From A. Nobel and G. Fehrenbach, Paris. Eng. Pat. 10,860, August 1, 1884.

AN air-tight cylinder of acid-proof material *a* is filled with fragments of glacial phosphoric acid, and surrounded with a sand-bath *c*, which permits of its being heated to a high temperature. On passing vapours of monohydrated or highly concentrated sulphuric acid through the pipe *g*, sulphuric anhydride is formed, and distils over through *b*, whilst at the same time the glacial phosphoric acid absorbs the water contained in the sulphuric acid, as well as a certain quantity of sulphuric acid, liquefies and flows off through *d*. From time to time a fresh supply of phosphoric acid is introduced through A. The residual liquid phosphoric acid, containing water and sulphuric acid, can be recovered by distilling off the sulphuric acid after adding some more water.—S. H.



Improvements in Apparatus for Concentrating Sulphuric Acid. P. Jensen, London. From A. Kux. Eng. Pat. 8803, June 10, 1884.

This apparatus (see Figs. 1 and 2) consists of an upper dome-shaped part *a* connected with a lower dome-shaped part *b*, by a system of tubes, through which the dilute acid circulates. The tube system is enclosed in a cylinder, through which steam is passed by the inlet *f* and outlet *g*. It is a special feature of apparatus constructed according to this invention that the steam does not pass through lead pipes, but outwardly surrounds a pipe system, through which the acid circulates. If a pipe becomes leaky, it can be stopped with a leaden plug; if it collapses, the apparatus still continues to work. The dilute sulphuric acid enters at *h*, and is heated in the tubes. Aqueous vapour passes away at *k*, a spray *l* fixing any acid mechanically carried over. A tube *d*, which is not heated, assists the circulation of the acid between *a* and *b*. The concentrated acid is drawn off at *i*. This apparatus is especially suitable for the concentration of the dilute acid from vacuum ice-making machines.—W. D. B.

FIG. 1.

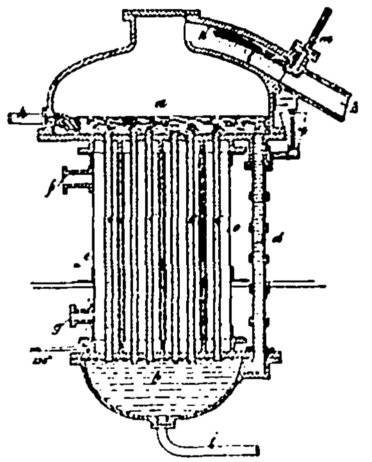
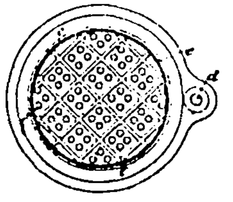


FIG. 2.



An Improved Method and Apparatus for Recovering the Nitrous Products in the Manufacture of Sulphuric Acid. C. D. Abel. From the Société Anonyme de Javel, Paris. Eng. Pat. 10,871, August 1, 1884.

The recovery of nitrous compounds in the manufacture of sulphuric acid by the employment of Gay-Lussac towers is unsatisfactory, because by these means there is not effected that intimate mixture of the gases which is necessary for the formation of nitrous acid that is absorbed by sulphuric acid. This invention relates to a method for effecting the required intimate mixture without resistance to the flow of the fluids. At the top of a tower, lined with lead, are placed several sets of apparatus delivering showers of concentrated sulphuric acid about 60° B., which descend on to a stratum of coke about a foot deep laid on a grating raised about a yard above the bottom of the tower. The gas enters under this grating, rises up through the showers of sulphuric acid, and is led by a pipe from the top down to the bottom of the Gay-Lussac tower.—S. H.

Apparatus for Concentrating Sulphuric Acid. A. J. Boult, London. From M. Willett, U.S.A. Eng. Pat. 9362, June 24, 1884.

The objects of this invention are to allow the acid to be rapidly and easily heated, to condense the vapours evolved at some distance away from the surface of the acid—thus obviating any cooling action at the surface of the acid,—to render possible the employment of light, and rolled instead of hammered platinum, and to reduce fuel consumption, size of apparatus, and loss of platinum. The boilers consist of platinum tubes about three feet in length and six inches in diameter, preferably arranged in a series at descending levels above an inclined furnace shaft. The tubes are supported by a number of iron plates set vertically at right angles to the length, and shaped to conform to the curve, of the boilers. The ends of the boilers project beyond the outside supporting plates, so that the solder-jointing of the ends is not exposed to the action of the fire. Plates of iron or other suitable material running lengthwise between the tubes prevent the portion of the boilers above the therein-contained acid from coming in contact with the flames or hot gases from the furnace. The boilers have gas openings at their tops in the centre, by which the vapours are conveyed to water arms, and thence to condensers. The connection of the boilers in series is effected by platinum tubes at alternate ends, each containing a slip-joint, this arrangement being rendered possible by the gradation of levels. These connecting tubes are so arranged that the first or highest boiler containing the weakest acid, and exposed to the least degree of heat, has a film of liquid not more than an inch and a-half deep; whilst the last or lowest boiler holding the strongest acid, and exposed to the greatest heat, from its position in front of the furnace, contains acid to the depth of two inches and a-half. The position of the connecting tubes is such that the acid from the surface of an upper or preceding boiler is carried to the bottom of that next below it. The capacity of production is stated to be from eighteen to twenty-two pounds per square inch, the loss of platinum six-tenths of a milligram per ton of oil of vitriol obtained.—W. D. B.

Improvements in Stills for Concentrating Sulphuric Acid. C. Bartsch. Eng. Pat. 6127, May 19, 1885.

A STILL for concentrating sulphuric acid which may be readily opened for inspection, and shall be less liable to fouling than the ordinary platinum still in use, is the subject of this invention. A in Fig. 1 is a trough of platinum, semi-circular in cross-section, and B is a flange secured to A near its top, and extending around its periphery, thus leaving a gutter C. D is a cover which rests in the gutter; E is the inlet pipe for the acid, and is placed near the top; F is an outlet for escaping fumes; G is an overflow pipe; H is the main outlet, leading into an equalising jar, whence the acid flows into convenient receptacles. The equalising jar consists of an inner and outer jar, between which a stream of cold water is passed. It is so placed that its outlet shall be level with the height at which the acid is desired to be kept in the still.

FIG. 1.

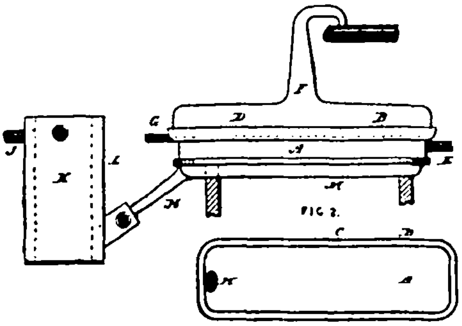


FIG. 2.

Before commencing to distil, the gutter C is filled with any liquid so as to form a hydraulic lute, and the equalising jar is filled with acid up to the level of its outlet. The acid to be concentrated is then allowed to flow slowly into the still through E. The main outlet is connected with the still at the point where the end-rise commences from the bottom, and thus will carry off acid from the very lowest portion of the still, whereby only that of the greatest specific gravity and consequent concentration flows off. The flow of the acid at the bottom outlet also carries off into equalising jar deposits of lead and iron sulphide contained in the acid and precipitated in the course of concentration, which would otherwise burn fast to the bottom of the still, and crack the bottom, owing to unequal expansion.—S. H.

VIII.—GLASS, POTTERY, AND EARTHENWARE.

Remarks on the Calculation of Mixings for the Manufacture of Glass. E. Tscheuschenr. Dingl. Polyt. J. **256**, 75.

NOTWITHSTANDING the many publications which appeared in the last decade on the chemical constitution and composition of glass, we are still in want of a practical method which allows of easily calculating the mixtures of raw materials for glass making. Although we know that many kinds of glass consist of a double compound of an alkali trisilicate and earth trisilicate, the proportion of both remains still to be settled. According to Benrath, this proportion should only vary from 1 : 1 to 5 : 7 for the best glasses, but R. Weber has lately shown that considerably greater variations may occur without detriment to the quality of the glass. The author has attempted to find out a relation between alkali, earth and silica for the different kinds of glass. If in the analysis of any glass xAO* expresses the alkali, yEO* the earth, and $zSiO_2$ the silica, all in equivalents, the composition of glass will be represented by the formula $xAO + yEO + zSiO_2$, where x, y, z may be figures variable between certain limits, according to the quality of the glass. For the normal composition of glass, these coefficients would have the value $x = y = 1$; $z = 3$ $(x + y) = 6$. But the formula $z = 3$ $(x + y)$ would only be right if $x = y$—that is to say, if the glass contains equal equivalents of alkalis and earths, the amount of silica should be six times as much. This formula is now compared with some analyses of glass, published by R. Weber, which has been found in practice to possess the physical qualities required. In these analyses there was—

x	y	z	$3(x+y)$	$\left(\frac{x^2}{y} + y\right)$
0·6	1	4·0	4·8	4·1
0·6	1	4·2	4·8	4·1
8·88	1	5·3	5·64	4·8
0·9	1	5·3	5·7	5·4
0·9	1	5·2	5·7	5·4
0·6	1	4·4	4·8	4·1
0·6	1	3·8	4·8	4·1
2·0	1	12·5	9·0	15·0
1·5	1	9·6	7·5	9·75
1·5	1	8·8	7·5	9·75
0·85	1	5·2	5·55	5·20
0·33	1	3·5	3·99	3·33

The first three columns represent the equivalent of alkali, earth and silica really found in the samples; the fourth column shows the figures which should have been expected if the amount of silica corresponded with $3(x + y)$, whereas the fifth column is calculated from another formula which was substituted for $3(x + y)$. As already mentioned above, z could only be equal to $3(x + y)$ if x be equal to y, but this was not the case in the samples tested. We also see that z is lower than $3(x + y)$ if x be smaller than 1, and *vice versâ*. The substituted formula $3\left(\frac{x^2}{y} + y\right)$ agrees much more closely to the results found by analysis, and we should now write our normal formula for the composition of glass, $xAO + yEO + 3\left(\frac{x^2}{y} + y\right)SiO_2$. We can further conclude from the analyses that if $y = 1$, x may vary from 0·6 to 1·0 for sheet-glass, from 1·5 to 2·0 for Bohemian flint-glass, and from 0·8 to 1·5 for white bottle-glass. Assuming these variations, we obtain the following formulas for the composition of sheet-glass ($R = K$ or Na).

1. $(0{\cdot}6R_2O + 1.CaO)4{\cdot}1SiO_2$
2. $(0{\cdot}7R_2O + 1.CaO)4{\cdot}5SiO_2$
3. $(0{\cdot}8R_2O + 1.CaO)4{\cdot}9SiO_2$
4. $(0{\cdot}9R_2O + 1.CaO)5{\cdot}4SiO_2$
5. $(1{\cdot}0R_2O + 1.CaO)6{\cdot}0SiO_2$

From these formulæ we can calculate the following percentage compositions for the two kinds of sheet-glass:—

Potash-Lime Glass.	Soda-Lime Glass.
1a. 0·6×47·1 = 28·26 = 15·7 K_2O	1b. 0·6×31 = 18·6 = 11·0 Na_2O
1·0×28·0 = 28·0 = 15·6 CaO	1·0×28 = 28·0 = 16·5 CaO
4·1×30·0 = 123·0 = 68·7 SiO_2	4·1×30 = 123·0 = 72·5 SiO_2
179·26 100·0	169·6 100·0
2a. 0·7×47·1 = 32·97 = 16·8 K_2O	2b. 0·7×31 = 21·7 = 11·7 Na_2O
1·0×28·0 = 28·00 = 14·3 CaO	1·0×28 = 28·0 = 15·2 CaO
4·5×30·0 = 135·00 = 68·9 SiO_2	4·5×30 = 135·0 = 73·1 SiO_2
195·97 100·0	181·7 100·0
3a. 0·8×47·1 = 37·68 = 17·7 K_2O	3b. 0·8×31 = 21·8 = 12·1 Na_2O
1·0×28·0 = 28·00 = 13·2 CaO	1·0×28 = 28·0 = 14·0 CaO
4·9×30·0 = 147·00 = 69·1 SiO_2	4·9×30 = 147·0 = 73·6 SiO_2
212·68 100·00	199·8 100·0
4a. 0·9×47·1 = 12·39 = 18·2 K_2O	4b. 0·9×31 = 27·9 = 12·8 Na_2O
1·0×28·0 = 28·00 = 12·1 CaO	1·0×28 = 26·0 = 12·8 CaO
5·4×30·0 = 162·00 = 69·7 SiO_2	5·4×30 = 162·0 = 74·4 SiO_2
232·39 100·00	217·9 100·0
5a. 1·0×47·1 = 47·1 = 18·4 K_2O	5b. 1·0×31 = 31·0 = 13·0 Na_2O
1·0×28·0 = 28·0 = 11·0 CaO	1·0×28 = 28·0 = 11·7 CaO
6·0×30·0 = 180·0 = 70·6 SiO_2	6·0×30 = 180·0 = 75·3 SiO_2
255·1 100·00	239·0 100·0

We will now illustrate the application of these formulæ for the production of sheet-glass of medium fusibility. Supposing there are the following raw materials :—

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* AO = alkali oxide; EO = earth oxide.

Nievelstein sand of 99% SiO_2
Ammonia soda ash of 98% CO_3Na_2(57·3% Na_2O)
Refined salt cake of 96% SO_4Na_2(42% Na_2O)
Ground Calc-spar of 97% $CaCO_3$(54·3% CaO)

According to formula *4b*, we should have to take for a suitable mixing—

(12·8 × 100) : 57·3 = 22·3kg. soda ash
(12·8 × 100) : 54·3 = 23·6kg. calc-spar
(74·4 × 100) : 99 = 74·2kg. sand ;

or in using salt cake, (12·8 × 100) : 42 = 30·5kg. salt cake.

Just in the same manner we can apply the other formulas for the production of glass, more or less fusible, just as required. The mixtures for cast plate-glass formerly contained far more alkali than they do at present. Whereas Henrivaux's analysis of an old plate-glass from St. Gobain showed

SiO_2	77·1%
CaO	6·0
Na_2O	16·2
Fe_2O_3 and Al_2O_3	0·7

corresponding to the proportion of equivalents 12·2 : 1·0 : 2·5, new plate-glasses have the following composition :--

Or, expressed in equivalents of silica, lead oxide and potash—

3·5 : 1·0 : 0·33 ; 4·7 : 1·0 : 0·8 ; 5·1 : 1·0 : 0·7 ; 6·5 : 1·0 : 1·0

whereas the normal formula would require

3·3 : 1·0 : 0·3 ; 4·9 : 1·0 : 0·8 ; 4·47 : 1·0 : 0·7 ; 6·0 : 1·0 : 1·0

There are also published analyses of flint-glass containing more and less silica than required by the normal formula. This shows that the easy fusibility of lead silicate allows of employing more silica than corresponding with the formula. But if less silica be employed, the glass will not be very durable. Indeed, it appears that these glasses are only specially prepared for optical purposes where a great refractive power is the principal aim. For cheapness' sake, a portion of lead oxide is often replaced by lime or baryta, or a mixture of either, and in this case the amount of silica agrees with our normal formula, as shown by Nehse and Schür's analyses of Mastrich half-crystal glass :—

SiO_2	61·9	65·5	57·5
PbO	16·0	16·0	25·4
CaO	4·5	9·1	4·1
BaO	6·3	—	—
K_2O	11·3	—	11·9
Na_2O	—	9·4	1·1

$SiO_2 : \underbrace{PbO+CaO+BaO} :$ Alkali—5·1 : 1 : 0·6; 4·7 : 1 : 0·7; 5·0 : 1 : 0·7

Calculated on our formula— 4·1 : 1 : 0·6; 4·5 : 1 : 0·7; 4·5 : 1 : 0·7

	From St. Gobain (Henrivaux).	From Montluçon (Henrivaux).	From Germany (Henrivaux).	From St. Gobain (Pelouze).	From Aix-la-Chapelle (Jaeckel).
SiO_2	72·1	69·3	70·27	72·1	72·31
CaO	15·7	15·8	15·86	15·5	14·96
Na_2O	12·2	13·1	13·66	12·4	11·42
Or expressed in equivalents	4·3 : 1 : 0·7	4·1 : 1 : 0·6	4·1 : 1 . 0·6	4·3 : 1 : 0·6	4·5 : 1 : 0·7

These very well agree with our normal formula, which would require thus :—

4·47 : 1 : 0·7; 4·08 : 1 : 0·6 ; 4·08 : 1 : 0·6 ; 4·08 : 1 : 0·6 ; 4·47 : 1 : 0·7

For white bottle glass, the proportion of the equivalents between lime and alkali should lie between 1 : 0·8 and 1 : 1·6, corresponding with the following percentage composition :—

	Soda-Glass.	Potash-Glass.
SiO_2	from 74 to 79·5	from 69·5 to 74·8
CaO	„ 14 „ 7·6	„ 13·0 „ 7·2
Na_2O	„ 12 „ 12·9	„ 17·5 „ 18·0

whereas for crystal glass (grinding glass), the proportion of lime and alkali should lie between 1 and 2, or, expressed in percentage—

SiO_2	78·6%
CaO	5·0
Alkali	16·4

Numerous analyses of good flint-glass also prove the applicability of our normal formula, thus :—

Of late years the demand for a glass combining cheapness and durability caused glass-makers to produce glass containing as much silica as possible. The amount of lead oxide had thus to be reduced, and this was replaced by potash, in order to guard against any appearance of a yellowish colour. But the quality grows inferior at the same time, a decrease of lead being accompanied by loss of weight, brilliancy, refractive and diversive power. In using 90% pearl-ash, normal mixtures are thus :—

Sand	100	100	100	100
Red lead	108	81	74	58
Carb. of potash	24	43	35	40

or for hard crystal-glass—

Sand	100	100	100	100
Red lead	73	63	56	48
Carb. of potash	24	17	15	26

or for soft optical glasses—

Sand	100	100
Red lead	130	200
Carb. of potash	26	14

	Flint-Glass (Weber).	French Crystal (Benrath).	English Flint-Glass (Berthier).	English Flint-Glass (Faraday).
SiO_2	45·12	48·1	51·1	55·13
PbO	47·06	38·0	37·1	31·20
CaO	—	0·6	—	—
K_2O	6·8	12·5	9·1	13·51
$Fe_2O_3 + Al_2O_3$	0·82	0·5	2·0	—
MgO	0·36	—	—	—
	100·46	99·7	100·3	99·84

Our normal formula is not applicable for the composition of green bottle-glass. Cheapness is here the first consideration, and therefore expensive alkalis must only be very economically used. Green bottle-glass can, indeed, be considered as a lime silicate, often containing alumina and magnesia silicate. On account of the absence of an alkali, the composition approaches that of a bisilicate. A higher amount of silicate cannot be attained without making the glass so difficult to fuse as to make it quite impossible to work it in our furnaces. As a matter of fact, the glass-maker finds it often necessary to add a little iron as a flux to avoid devitrification. French bottle-glass, of latest make, had the following composition, according to Henrivaux :—

	Cognac.	Bordeaux.	Champagne.
SiO_2	62·54	61·75	61·90
Al_2O_3	4·42	7·10	4·44
Fe_2O_3	1·34	2·70	1·85
CaO	20·47	19·60	17·95
MgO	5·41	4·55	6·18
Na_2O	4·73	4·10	6·16
MnO	4·73	0·11	6·16
K_2O	0·94	0·11	1·13
SO_4H_2	0·10	0·09	0·17
	99·95	100·00	99·98

Proportion of equivalents—

2·0 : 1·0 : 0·1   2·0 : 1·0 : 0·1   2·0 : 1·0 : 0·2

Supposing the following raw materials have to be used for bottle-glass making :—

Gneiss, composed thus—

SiO_2	64·17%
Al_2O_3	13·87
FeO	6·40
CaO	2·74
MgO	2.21
K_2O+Na_2O	7·63
H_2O	1·01
	98·03

Sand of 90% SiO_2; 5% Fe_2O_3 and 5% Al_2O_3, and limestone of 91% $CaCO_3$; 5% SiO_2 and 4% $Al_2O_3 + Fe_2O_3$.

a suitable mixing would be 100 parts gneiss, 70 parts limestone, and 60 parts sand.

Parts	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	K_2O+Na_2O	Tl.
100 gneiss contain ..	64·17	13·87	6·10	2·74	2·21	7·63	97·02
70 limestone ,, ..	3·00	2·40	—	35·70	—	—	41·10
60 sand ,, ..	54·00	3·00	3·00	—	—	—	60·00
	121·17	19·27	9·10	38·44	2·21	7·63	198·12

The bottle-glass obtained would therefore have the following composition—

	%		Equivalents.	
SiO_2	61·2			=2·04
Al_2O_3	9·6	=	0·18	=1·03
Fe_2O_3	4·7	=	0·11	
CaO	19·4	=	0·69	
MgO	1·1	=	0·05	
Alkali	4·0			=0·10
	100·0			

which corresponds well with Henrivaux's analyses of French Cognac and Bordeaux bottle-glass.

We may therefore say that whereas in the composition of green bottle-glass the formation of a bisilicate is all that can be aimed at, for all other kinds of glass with x equivalents of alkali and y equivalents of earths we can arrive at the amount of silica z in equivalents by applying the formula $z=3\left(\frac{x^2}{y} + y\right)$.—S. H.

Contributions to a Knowledge of Opal or Cryolite Glass. C. Weinreb. Dingl. Polyt. J. **256**, 361.

Oxide of tin, which doubtless formed a difficultly-fusible tin enamel, was first employed for the above variety of glass; this was replaced later on by calcium phosphate from the ashes of bone and guano—the majority of mineral phosphates such as phosphorites and apatite are too rich in iron for the purpose, the product being known as bone-glass. In 1860, in North America, an opal glass was prepared by the use of cryolite, $Al_2F_6,6NaF$, and since that date this material has been employed almost exclusively. Seeing that the price of cryolite has risen greatly, a substitute for cryolite is desirable. It is then first necessary to determine on what circumstances or materials the production of milk-glass depends. In 1869 Benrath examined American cryolite glass, and finding no fluorine, advanced the opinion that the opalisation was due to a separation of alumina, and designated this phenomenon "devitrification"; he also concluded that the whole of the fluorine had been volatilised as silicon fluoride. In the same year, a cryolite glass from the same source was examined by Williams, who found that it contained fluorine, and ascribed the opalization to a formation of silicofluoride of sodium, which dissolved in the molten glass, but separated on cooling. The statements of these two observers, as to the presence of fluorine, being so contradictory, the author analysed an Austrian cryolite glass, with the following results :—SiO_2, 78·00; Al_2O_3, 3·12; Fe_2O_3, trace; MnO, trace; CaO, 3·87; Na_2O, 9·46; K_2O, 4·35; F, 3·77; total, 102·57; less O corresponding to F, 1·59=100·98. From these numbers the proportions of the materials of the charge may be calculated with approximation to have been—SiO_2, 100; Al_2F_6, 6NaF, 15·91; Na_2CO_3, 8·13; K_2CO, 7·91; $CaCO_3$, 8·55. The amount of alumina found is a measure of the cryolite added, and from the proportions respectively which alumina bears to fluorine in cryolite and in the glass, it appears that during the melting, 4·11 parts of fluorine per 100 of SiO_2 are volatilised as a silicon fluoride. With a view of determining whether the formation of milk-glass is due to (1) alumina, (2) fluorine, or (3) alumina in conjunction with fluorine, the author has made synthetical experiments recorded in detail. The results show conclusively that only in conjunction with fluorine has alumina the power of causing "devitrification," this depending, apparently, upon the formation of aluminium fluoride which dissolves in the molten mass, but separates out in a most minute state of subdivision on cooling. If milk-glass manufacturers desire to dispense with the use of cryolite, recourse must be had to materials rich respectively in alumina and fluorine; in regard to the first there is little difficulty, as kaolin and felspar, free from iron, are readily obtained; in respect of the second, there is practically no choice but to employ fluor-spar, which it will be necessary to convert into an alkaline fluoride by fusion with sodium carbonate, since too much lime would be introduced into the glass were the fluor-spar directly added. The author has found by experiment that the yield of alkaline fluoride is much greater if an equal weight of silica be added before fusing with sodium carbonate. The melt is lixiviated, the solution consisting of alkaline fluoride and silicate is evaporated to dryness, and the dry residue added directly to the charge.—W. D. B.

X.—METALLURGY, MINING, Etc.

Progress in Metallurgy.

Zinc Extraction. Dingl. Polyt. J. **256**, 317-321.

L. Kleeman's modification of his condenser for zinc distillation is described; the object of the modification being to prevent escape of zinc vapours at the front of the furnace. (Ger. Pat. 28,596, December 14, 1883.)

Bessemerising Copper Ore and Matte. J. Garnier. Ger. Pat. 30,418, July 3, 1884.

A modified Bessemer converter for the above process. The lining is to be made either of siliceous material, or of materials which are not attacked by silica or bases, such as chrome iron ore, calcium sulphate, zinc silicate, calcium phosphate, etc. When an acid lining is employed, it is to be so thin that a layer of slag or matte may be chilled upon it by cooling the exterior of the vessel with an air or water-jacket.

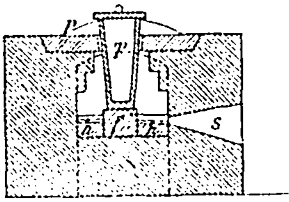
Furnace for Smelting or Fusing Metals. J. Quaglio, J. Pintsch and A. Lentz. Ger. Pat. 29,551, March 9, 1884. (See this Journal, vol. iii. p. 639.)

The arrangement consists of two shaft furnaces placed near together, and connected at the top and bottom by flues, in the latter of which are placed suitable valves to control the gaseous currents. The gases from one shaft are passed into the top of the other, and down through a mass of ignited fuel, and then into a gas-holder for distribution as required. The shafts are charged with fuel and ore, and the liquid products are removed in the usual way.

Fusion of Zinc Alloys. G. Selve. Ger. Pat. 29,535, June 21, 1883.

The patentee proposes the furnace shown in Figs. 1 and 2 for the preparation of zinc alloys. Crucibles T project through the roof of the furnace, and stand on refractory stands F. The crucible is somewhat smaller than the hole in the roof, so that the two are not in contact. The sole slopes on all sides towards the middle, so that when a crucible breaks, the spilt metal can be tapped off at S. In the preparation of brass, for example, after the requisite amount of copper is fused, the whole of the zinc is quickly added, and so much scrap brass as will make the contents pasty. By this means cold layers of metal are formed in the upper part of the crucible. Since the crucibles project from the furnace this reduced temperature at the surface of the metal is easily maintained by the addition from time to time of scrap. By this means very little loss of zinc results. On drawing the crucible and stirring up the contents a uniform alloy is produced.—J. T.

Fig. 1



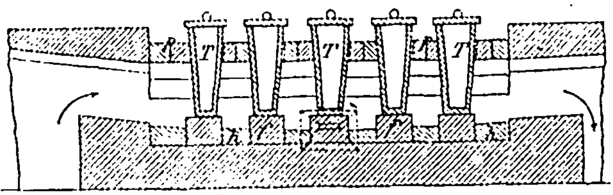


FIG. 2

Coating Iron and Steel with Copper and its Alloys. J. J. Taylor, Wolverhampton. Eng. Pat. 10,886, August 2, 1884.

The articles are pickled as if for galvanising, and are then immersed in a hot solution of one pound borax to four gallons water. The articles are dried and immersed in the copper or copper alloy bath; the flux employed through which to enter the articles consists of borax. Common salt is added from time to time to thin this flux. The flux employed over the part of the bath where the articles are withdrawn after being coated, consists preferably of glass, though borax, alone or with glass, may be employed.—J. T.

Improvements in the Method of and in Apparatus for Extracting Gold and Silver from their Ores by Amalgamation. H. M. Whitehead, London. Eng. Pat. 11,701, August 27, 1884.

The amalgamator consists of a series of air-tight chambers, each containing a vertical partition reaching from the top to within a short distance of the bottom, and having its lower edge toothed. One-half of one terminal chamber is connected with an exhauster, and the reverse half of the other terminal is in communication with an ore-feeding channel. A door is arranged at the lowest part of each chamber for the removal of amalgam, and a gauge glass is fitted to each pair of compartments. When required for use, mercury is poured into each chamber until the row of teeth is just covered, the exhaust is let on, and the ore fed in at the other end. The ore (dry or with water) is thus carried by suction beneath the division; and, therefore, through the mercury in each successive compartment until it passes away through the exhaust outlet. Flouring is to be prevented by the use of sodium amalgam or otherwise.—W. G. M.

An Improved Method of Extracting Copper, Nickel, Cobalt, Silver or Gold from their Ores. Lorentz Albert Groth, K.G.V., London. From C. G. Dahlerus, Denain, France. Eng. Pat. 5642, May 7, 1885.

The ore is to be roasted, mixed with chloride of lime or similar substances, and dilute acid: the resulting solutions of the metals is then precipitated in the usual way.
—W. G. M.

Improvements in Method of and Apparatus for Reducing Ores. J. K. Griffin, Brooklyn, U.S.A. Eng. Pat. 6124, May 19, 1885.

The ore is fed through a hopper into a rotating distributor, having openings in its periphery for the discharge of the ore, and contained in an outer shell also revolving, but at a higher speed and in an opposite direction. The ore, thus fed in, becomes packed by the action of the centrifugal force against the inner wall of the shell until the accumulation has reached to the circumference of the distributor, then for the first time the pulverisation commences by the mutual attrition of the particles of ore. As fast as the substance is reduced to the required degree of fineness, the powder is carried away by currents of air introduced through channels in the distributor, and is collected in suitable receivers. The degree of fineness obtainable will vary (inversely) with the velocity of the air current. For certain ores it is preferable that the shell only rotate, the distributor remaining fixed. Experiment has shown that velocities of 150 to 200 revolutions per minute, in opposite directions, suffice to crush hard rock, such as quartz, to an impalpable powder in satisfactory quantities, and without injury to the machine, and without admixture of foreign substances.—W. G. M.

XI.—FATS, OILS, AND SOAP MANUFACTURE.

Measurement of Frictions of Lubricating Oils. C. J. H. Woodbury. Bull. Mulhouse, 323, 1885.

This is a report by M. Scheurer-Kestner upon a paper bearing the above title, recently communicated to the Société Industrielle. The subject has been investigated by the dynamical method, and by means of an apparatus consisting essentially of a couple of discs with plane opposing surfaces, the lower of which is rotated by the direct application of power, the upper tending to be drawn into rotation by contact; this tendency is resisted and its quantity registered by means of a dynamometrical suspension. The oil to be tested is supplied continuously through a tube passing through the upper disc, which also contains an annular hollow through which a stream of water is made to circulate, when the experiments are to be made at constant temperatures. The quantitative expressions for the friction are obtained ultimately in terms of the dynamometer readings and the weight of the upper disc, and the results are given in three tables appended to the original paper. In the first are contained the results of varying the temperature from 40° to 100° F., and the downward pressure upon the upper disc from 1 to 40lb. per square inch. An inspection of the diagram, by which the numbers are graphically represented, shows that the force tending to rotate the upper disc does not increase proportionately to the pressure; this is due to the influence of the cohesion of the oil itself, in consequence of which it participates in the rotation. The second table gives the value of the coefficients of friction for the same series of experiments, calculated by means of an equation deduced from a

consideration of the special conditions of the apparatus, and of the phenomena to be investigated. In general terms, the introduction of the third lubricating substance, between the opposing surfaces, approximates the molecular problems involved to those of the flow of liquids from minute orifices. The coefficient of friction is seen from this table to diminish with increase of pressure, and of fluidity of the oil. The practical limit of fluidity is the necessity of preventing contact of the opposed surfaces. In the third table the effect of varying the temperature is shown by the numerical results obtained with a very fluid mineral oil, the pressure on the upper disc being kept constant at 33lb. per square inch. The maximum of useful effect was reached at 82° F. In conclusion, the author discusses the subject generally, showing to what extent purely scientific methods may be made to contribute to the elucidation of the very practical question of the value of lubricants.
—C. F. C.

Test of Mineral Lubricating Oils. P. Falke. Chem. Zeit. **9**, 906.

Mineral lubricating oils are often adulterated by the addition of cheap oils. The following tests may serve for ascertaining their purity:—(1) Colour. The oil must be perfectly clear, and as light as possible. It should not be turbid, which may be caused by the presence of water or other substances. If the oil be turbid by water, it froths on heating, whereas a turbidity produced by solid matters, such as paraffin, disappears on warming, and reappears on cooling. The characteristic feature of all mineral oils is their blue fluorescence. (2) Smell. The smell must be as little perceptible as possible, and should not increase on warming the oil. It mostly smells like petroleum. (3) Behaviour on shaking with water. If three parts of oil be shaken with one part of water in a test tube, warmed, and allowed to stand in a water-bath for some time, no emulsion must appear between water and oil, but the latter should stand clear above the water, which should opalesce only very faintly, and be perfectly neutral. (4) Behaviour to caustic soda. The oil should not be attacked by a caustic lye of 1·40 sp. gr., neither in the cold nor on warming. Saponification is a certain evidence of the presence of animal or vegetable fat. (5) Behaviour to sulphuric acid. On mixing the oil with sulphuric acid of 1·60 sp. gr. it must not be coloured brown, but yellow at the most; otherwise resins have not been carefully removed. (6) Behaviour to nitric acid. On mixing oil with nitric acid of 1·45 sp. gr. a rise of temperature takes place, which should not exceed a certain limit. (7) Specific gravity. Although the specific gravity of oils suitable for lubricating purposes varies from 0·875 to 0·950, only a very small latitude (0·003 at the most) is permitted in contracts. It is invariably taken at 15° C. (8) Behaviour on exposure to the air and heat. Spread in a thin layer and exposed to the air for some time, its consistency must not change, nor should it become acid on being heated continuously above 150°. Heated in open vessels it should not give off combustible vapours, except at a high temperature, which is usually specified in contracts. Its flashing point should be ascertained in Abel's apparatus. (9) Behaviour at a low temperature. It should bear a low temperature without losing its lubricating power, nor should it become solid even at a very great cold, but it should rather assume the appearance of an ointment. (10) Test for consistency. This determination is most important. The velocity of efflux of pure rape-seed oil is taken as a standard, and that of the mineral oil compared with it. 100cc. of the sample are allowed to flow out of a burette with tap, while the time which is required is noted down. In conclusion, the author urges the desirability of having a uniform mode of testing.—S. H.

An Improved Process for the Extraction of Oil and the Production of Meal from Flax and other Seeds. H. H. Lake. From C. G. B. Casero, of St. Etienne, France. Eng. Pat. 11,403, August 18, 1884.

Instead of, as usual, heating and then pressing the whole bulk of the linseed, the patentee reduces it to coarse powder, and separates the meal by sifting into two parts about equal in weight. The part which goes through the sifters contains nearly the whole of the oil, which may be thus expressed without torrefaction. A purer oil is the result, and there is far less tendency to form an emulsion, as the mucilage remains in the portions which do not go through the sifter, which also thus form a novel linseed meal.—W. L. C.

A New Method of and Apparatus for Making Emulsions for different Purposes. C. J. P. de Laval. Eng. Pat. 12,562, September 18, 1884.

Emulsions of fats and oils, both for food purposes and as lubricants, are prepared by forcing liquid fat or oil, under high pressure, into liquids at lower pressure, in finely-divided streams, through minute apertures. The apparatus consists essentially of two reservoirs and a force-pump, the outlet of which is a heavily-loaded valve, adjustable by a fine-threaded screw. Drawings are given.—W. L. C.

Improvements in Apparatus for Lard Refining, Cooling, and Filling. C. F. Hodges and W. Christy. Eng. Pat. 12,720, September 23, 1884.

The apparatus, which is figured, consists of (1) a refining tank provided with a steam-jacket and mechanical stirrers; (2) a cooling tank provided with dashers or stirrers, and circulating pipes for hot water or steam; (3) filling apparatus with clips and nozzles, mechanically operated.—W. L. C.

XII.—PAINTS, VARNISHES, AND RESINS.

The Darkening of Oil Colours. R. Kayser. "Mittheilungen des bayerischen Gewerbemuseums," 1885, p. 21.

The author's observations confirm the statement that if a varnish boiled with litharge be rubbed up with cinnabar, a formation of sulphide of lead gradually results. In oil painting only varnish prepared with borate of manganese should be employed, for the author ascribes the darkening of oil-colours to this gradual formation of lead sulphide.—W. D. B.

XIII.—TANNING, LEATHER, GLUE, AND SIZE.

Adulteration of Leather. R. Kayser. Chem. Zeit. **56**, 1001.

Starch sugar is added frequently to increase the weight, as leather is eight or ten times as dear as this adulterant, and the sophistication cannot be detected without chemical investigation. On examination of different samples of leather, the author finds grape-sugar present in quantities varying from 2·7 to 7·6 per cent.—S. R.

XV.—SUGAR, GUMS, STARCHES, Etc.

Sugar Beet Farming. Dingl. Polyt. J. **256**, 374.

Wrede places the cost of sugar beet growing in the province of Hanover at 2·5 marks per double centner, inclusive of leaves and cuttings. How much of the cost of production is to be subtracted on account of these two last items is doubtful.

Lach shows that beets grown in the shade are inferior to those in the open.

By cultivation experiments on nine different estates, Maercker has found that on an average the highest sugar contents per beet—viz., 14·9 per cent.—was obtained with Dippe's Improved White, but the best total yield of sugar with Klein-Wanzlebener Original crossed with Vilmorin Klein-Wanzlebener.

The importance of cultivating varieties as rich in sugar as possible is shown by the following results:—

	Variety rich in Sugar.	Variety poor in Sugar.	Difference.
Yield per morgen....	181centnr.	192centnr.	−8
Sugar in the beet....	14·3	12·5	−+1·8
Degree Brix	18·5	16·8	−+1·7
Sugar in the juice ..	15·9	14·0	−+1·9
Quotient	85·9	83·3	−+2·6
Sugar per morgen ..	26·31	24·0	−+2·31

—W. D. B.

Some Reactions of the Glucosides Helicin and Glucovanillin. F. Tiemann and A. Kees. Ber. **18**, 1657-1665.

In studying the formation of such glucosides as these in the plant, the authors endeavour to obtain light as to the physiological processes in the vegetable organism giving rise to them. Therefore a trustworthy test for these glucosides would be of extreme value. The authors claim the introduction of the phenylhydrazine and hydroxylamine derivatives for this purpose, which give characteristic reactions. They are prepared with great facility; the former derivatives by gently heating either helicin or glucovanillin with phenylhydrazine hydrochloride—the new hydrazines separate on cooling; the latter derivatives by heating in molecular proportions a slightly alkaline alcoholic solution of either of the glucosides with hydroxylamine. When the reaction is complete the mixture is neutralised, evaporated to dryness, and extracted with absolute alcohol. *Helicin phenylhydrazine*, $C_6H_4(CH.N_2HC_6H_5)(OC_6H_{11}O_5)[1:2]$, is soluble in alcohol, ether and hot water, almost insoluble in cold water, and insoluble in benzene. It is deposited from its aqueous solutions in white, scarcely crystalline masses, which turn brown without apparent decomposition when dried in the air. The dry substance melts at 187°. It does not reduce Fehling solution. The hot aqueous solution is yellow, by prolonged boiling the colour becomes paler, and the substance undergoes partial decomposition. Emulsion resolves it into the hydrazine of salicyl aldehyde, identical with that of Fischer (*Ber.* 17, 575) and Rössing (*Ibid.* 3004), and glucose identified by the Fehling- and by Fischer's hydrazine-reaction. *Glucovanillin phenylhydrazine*,

$$C_6H_3(CH.N_2HC_6H_5)(OCH_3)(OC_6H_{11}O_5)[1:3:4],$$

crystallises from its solution in boiling water, is readily soluble in alcohol, sparingly in cold water, and almost insoluble in benzene and ether. It is coloured brown in the air, and when dry melts at 195°. It produces a green precipitate in, but does not reduce Fehling solution. With emulsion it yields glucose and *vanillin phenylhydrazine*, $C_6H_3(CH.N_2HC_6H_5)(OCH_3)(OH)[1:3:4]$, which forms greyish-white leaflets (m.p. 105°) with silver lustre, and when moist become discoloured in the air. The crystals are readily soluble in alcohol, ether, and benzene, but very sparingly in water and light petroleum. *Helicin aldoxim*, $C_6H_4(CH.NOH)(OC_6H_{11}O_5)[1:2]$, crystallises in fine white needles (m.p. 190°) with 1mol. H_2O, which loses at 100°. It is insoluble in ether, but slightly soluble in alcohol, moderately so in water, whilst it dissolves readily in both acids and alkalis, but is partially precipitated from concentrated acid solutions by ammonia. It gives no characteristic colour reaction with concentrated sulphuric acid. It is powerfully lævorotatory. Emulsion converts it into glucose and *salicyl aldoxim* (see Lach, *Ber.* 17, 1785). *Gluco-vanillin aldoxim*, $C_6H_3(CH.NOH)(OCH_3)OC_6H_{11}O_5)[1:3:4]$, forms light yellow needles (m.p. 152°) with 1mol. H_2O, which is driven off at 100°. It is less soluble in water and alcohol than helicin aldoxim, but behaves in a similar manner to that substance with the other reagents, and the polariscope. With emulsion it yields glucose and *vanillin aldoxim* (comp. Lach., *Ibid.* 1786). In all the above reactions the aldehyde group of the glucosides is attached, and the authors could not induce action between ether phenylhydrazine or hydroxylamine, and the glucose nucleus of these and many other glucosides —*e.g.*, salicin, coniferin, etc.; in this they resemble the kind of sugars termed by Scheibler "Biosen," which do not react until they are inverted.—D. A. L.

Constitution and some Properties of Raffinose. C. Scheibler. Ber. **18**, 1779-1786.

The author confirms the identity of raffinose with "plus-sugar" and "gossypose" (see this Journal, iv. 411). Loiseau found fifteen per cent. of water in raffinose, and attributed to it the composition indicated by the formula $C_{18}H_{32}O_{16}+5H_2O$. Ritthausen, on the other hand, found only 13·64 per cent. water in his sugar from cotton seed, and concluded it was $C_{12}H_{22}O_{11}+3H_2O$. These different results are due to the difficulty attached to drying raffinose; heated at 85° to 90° below its melting point, it loses only 13·64 per cent. of water; when it is heated higher, even at a little above 100°, it begins to caramelise, and becomes to a certain extent inverted; raffinose is hence much more susceptible to change than raw sugar, which does not caramelise under 160°. By drying this sugar, as far as possible (until the loss = 13% water), over sulphuric acid, and then in a water-bath the author is able to confirm Loiseau's view of the composition of raffinose. The author finds its specific rotation is $\frac{\mathrm{I}}{\mathrm{D}} = +103{\cdot}9$ to 104, or $\frac{\mathrm{I}}{\surd}{\cdot} = 114{\cdot}6$. By treatment with acid at 17—18° C. its rotatory power diminished at first rapidly, later on slowly, and after ten days was constant at +52·3. At higher temperatures this change takes place quicker: at 60°, for example, the specific rotation is reduced to +53·2 in three hours, and to 46·7 in sixteen hours; the solution then becomes yellow, and the colour increases as the heating is continued. The author suggests that the rapid reduction in this rotation is due to inversion, whilst the slower decrease is perhaps the result of a subsequent change in the product of inversion. This point is being investigated with phenylhydrazine, and otherwise. From these properties of raffinose, and as it is found associated with a betain both in cotton seed (*loc. cit.*) and in beet, the author infers that it is present in the original beet. Its easy inversion and caramelising, and its high specific rotation, go far to explain the reduction in polarisation and partial inversion of beet-juice during the winter storage of roots in heaps. Roots of high rotatory power suffer much quicker and to a greater extent than other roots; these roots are supposed to be poor in juice because they yield less sugar than their rotatory power indicates. It is now evident that this supposition is not correct, but, in fact, these roots contain a large percentage of raffinose, which would account for the high rotatory power, for the bad-keeping properties, etc. The behaviour of many sugar residues suggests the presence of raffinose. The identity of *raffinose* and melitose is not yet confirmed. Raffinose containing C_{18} would be classed, according to the author, as a "Trios" sugar.—D. A. L.

XVI.—BREWING, WINES, SPIRITS, Etc.

Extracts from the Report of the Meeting of the Brewery Institute in Berlin. Chem. Zeit. **9**, 638.

Dr. Hayduck explained the value of hops in their effect upon the keeping power of beer. The antiseptic action of hops in beer fermentation is perceptible even in the proportion of 0·25 hops to 500 of the wort. The effect of 1—15 parts of hops on the different bacteria is approximately the same. It follows that the antiseptic principle of hops is with difficulty soluble. Hops of the same kind act in the same way even when the extraction has gone on a longer or shorter time. Different kinds of hops, however, act very differently. The less valuable, but fresh hops, including wild hops, are not inferior in their action on the fungus to the better qualities. Sulphuring hops does not improve matters. Hop-extracts of commerce were found to be useless. Hayduck considers the resins in the hops, of which he isolated two kinds, to be the antiseptic agents in the case of all bacteria. The bitter principle cannot be separated from the resin. The disappearance of the bitter principle in the course of fermentation by separation of the resin and oxidation has been fully confirmed. Preserved hops are also efficient in their action. In the discussion which followed, the feeling of practical brewers was against economy in the use of hops. They supported, however, the new method of boiling hops, which effects a certain economy. In considering the action of the pure-cultivation yeast obtained from the single cell, opinions were divided. In certain instances the results were excellent; in others, again, the fermentation was arrested, and a peculiar taste was imparted to the beer. Delbrück suggested that probably a higher temperature would produce a yeast freer from bacteria—that is to say, the isolation of the pure yeast. The method of Hayduck for regenerating the yeast by treatment with sugar solution of hops at a high temperature was strongly supported by the result of actual experiment. For washing the yeast, very cold water was recommended.

Dr. Francke spoke on the subject of the barley of the present year. He laid stress upon the troublesome treatment of kiln-drying in the use of stored malt of different sorts. According to Nervack, a stored malt is more moist, and forms, therefore, on grinding, a coarser material for the mash, which favours, therefore, the process of cleansing. To obtain a better quality of barley, it was proposed that the results of experiments with the barley of a certain district, together with the analysis, be communicated to the Agricultural Society before seed-ordering, in order to be in a position to choose a better brewing barley for seed.

Attention was called to the use of manures, as in many cases artificial manuring with Chili saltpetre and kainite was found injurious. Balcke suggested the use of kilns constructed with air ventilation, to prevent browning of the moist malt. Zimmer's centrifugal apparatus promises an extended use. The discoverer hopes to prevent frothing of the colder worts by changing the exit of the worts from the centrifugal. The cause of the red-colouring of white beer is supposed to be due to the presence of spherical bacteria. Different views were held on the subject of brewing-water. The efficiency of hard water was generally admitted. It was recommended to boil the water, and let settle before use, even with iron and calcium carbonate present.—J. B. C.

The Valuation of Pressed Yeast. W. Gintl. Ber. der Oesterr. Chem. Gesellschaft, 1885, p. 2.

The comparative efficiency of different samples of yeast is best arrived at by comparative fermentation experiments, but when it is necessary to obtain absolute expressions, it is not sufficient, in addition to the usual microscopic and qualitative tests, to ascertain the amount of true yeast material present—it is also necessary to determine the proportion which the yeast bears to the starch. The author has found by analysis that an increase in the starch contents usually causes an increase within a certain limit—in the percentage of true yeast material, the diminution being in the water. The starch, however, by abstracting water from the yeast-cells causes a considerable proportion of these to shrink and wither, without absolutely killing them; so that the increased percentage of yeast material caused by the addition of starch results in a decreased efficiency; the fermentation is more feeble at the commencement, but more vigorous later on, when the proportion of starch to yeast is larger than when the reverse is the case. The addition of starch is not considered desirable by the author; it does not result in increased efficiency, and it is but a replacement of water, which costs nothing, by a comparatively costly material.—W. D. B.

Process for Preventing Subsidiary Fermentations in Substances employed in the various Manufactures based on Fermentation. C. D. Abel. From Dr. C. Meyer, Uerdingen, Germany. Eng. Pat. 5439, May 2, 1884.

This patent aims at removing from distillers' fermentations, micro-organisms, which would act injuriously upon the fermentation process and upon the quality of the product. The removal is effected by adding a voluminous body to the mash and filtering; this completely removes bacteria. The voluminous bodies used are:—

1. Freshly precipitated hydroxides, such as aluminium hydroxide.
2. Insoluble amorphous combinations, as phosphate of iron.
3. Silicic acid precipitated from its combinations.
4. Albumen, starch paste, etc.

The process can also be used for preparing an artificial ferment free from lactic acid-bacteria. The advantages claimed for the process are: Improved saccharification, pure fermentation, high yield of alcohol, reliable working, and complete utilisation of the starch in the malt.
—G. H. M.

Improvements in the Mode or Process of and Apparatus for Generating Carbonic Acid Gas, to be used in the Aeration of Draught Ale and other Beverages. W. H. How, Ongar. Eng. Pat. 10,109, July 14, 1884.

This apparatus consists of an outer vessel containing a solution of a carbonate or bi-carbonate, and a small narrow-necked vessel filled with sulphuric acid made into a paste by absorption with alum, covered with a tubulated bell-jar, and placed on the bottom of the outer vessel. The bell-jar is provided with stopcocks, and when these are opened the solution enters the bell and flows in upon the absorbed acid. The evolved carbonic acid bubbles through the solution, and is thus washed. When the apparatus is not required for use, the acid vessel is either closed by an automatic or other valve, or the stopcocks are closed, and the solution expelled from the bell by the accumulated carbonic acid.—W. D. B.

Improvements relating to the Extraction from Grapes or Raisins of various Substances, and to the Use or Application of the same for Colouring or other Purposes. E. H. Newby. From E. Thiebaut, Montdidier, France. Eng. Pat. 10,100, July 24, 1884.

This is a process for extracting the colouring matter from grapes or raisins, and from the residue in the manufacture of wine, by means of digesting with hot dilute alkali, and precipitating the colouring matter from the filtered solution with dilute hydrochloric acid. The precipitate is then purified by digestion with ammonia solution at 30° C. for some days. The colouring matter goes into solution, and can be obtained by distilling off the ammonia. The extracted substance may be used as a dye, or a pigment, or for colouring wines and articles of confectionery. It has tanning properties, and is a fast colour. In place of alkalis, the following substances may be used for extracting the colouring matter: Alcohols, ethers, turpentine, wood-spirit, carbon disulphide, acids, glycerine, or the wine itself.—G. H. M.

Process and Apparatus for Purification of Alcohol. C. D. Abel. From J. A. F. Bang and M. C. A. Ruffin, both of Paris. Eng. Pat. 10,870, Aug. 1, 1884.

This invention relates to a method and apparatus for purifying crude alcohol in order to obtain, by one single process of distillation, the total amount of ethylic alcohol free from essential oils and aldehyde. This is done by removing these latter with a solvent from the alcohol at 50° B. The solvent used is what is known as essence of petroleum, purified by shaking with strong sulphuric acid. The essential oils and aldehyde dissolve in this on agitation; whilst the hydrocarbon itself is insoluble in alcohol of 50° B. The hydrocarbon can be regenerated

by treatment with strong sulphuric acid. After treatment with the petroleum spirit, the alcohol is rectified as usual. A plan of the apparatus used is appended.
—G. H. M.

Improvements in Beverages resembling Beer, and in the Process of Manufacturing the same. Thomas Etty, Liverpool. Eng. Pat. 11,297, August 15, 1884.

THIS is a process for manufacturing non-intoxicating beverages resembling beer from pearl-barley, malt, hops, sugar, and flavouring by boiling with water, and fermenting the liquid obtained with barm.—G. H. M.

Improvements in the Manufacture of Champagne or Sparkling Wines. J. C. Mewburn. From The Société Anonyme "La Vinicole." Eng. Pat. 12,105, September 6, 1884.

THIS invention consists in manufacturing sparkling wines by fermenting a mixture of wine and condensed must in a closed vessel, under pressure, at a temperature of 25° C. for twenty to twenty-five days. The wine is then transferred to another vessel, under a pressure of about six atmospheres, cooled, clarified and bottled, still under pressure. It is claimed that this yields a perfect wine in flavour and keeping power, and avoids the expense and loss incurred in the ordinary process of preparing sparkling wines. The amount of condensed must used varies from five to fifteen per cent., depending upon the nature of the wine employed.—G. H. M.

XVIII.—ELECTRO-CHEMISTRY.

Alloy for Electrical Conductors. H. H. Lake, London. From T. Shaw, Newark, New Jersey, U.S.A. Eng. Pat. 10,932, August 5, 1884.

THE object of this invention is to produce an alloy of aluminium, copper and phosphorus. The conductivity of this alloy is greater than that of iron, steel or phosphor-bronze. Alloys of copper containing from less than one per cent. to more than five per cent. of aluminium, and from one-twentieth to one per cent. of phosphorus, are employed. The amount of tensile strength required will regulate the proportions within the above limits. The copper is first melted, and the aluminium is added, a small quantity at a time, with a flux of palm oil, stirring well all the time with a pine stick; the phosphorus is then added, with stirring, and the alloy is poured into chill moulds.—J. T.

Elements for Voltaic Batteries. D. G. Fitzgerald and T. J. Jones, London. Eng. Pat. 1831 (September 25, 1884), 1885.

IN place of zinc the inventors employ as the positive element, lead, which is readily reducible from most of its compounds; as the negative element they employ a conductor (preferably of lead or carbon), coated or maintained in contact with lead peroxide. They claim (*a*) the use, for the purpose of electrolytically obtaining in bulk material for the elements of voltaic batteries, of a paste composed of equivalents of sulphate of lead and magnesia, or of lead sulphate, and an alkali; (*b*) the production of a negative element by subjecting a lead plate to electrolytic action as an anode in a solution of magnesium sulphate, in conjunction with a cathode, consisting of a number of superposed trays, containing a lead compound, to be reduced to the metallic form; (*c*) the treatment of lead sulphate obtained as the spent material in the working of lead primary batteries, with an alkaline solution, prior to reconverting such sulphate into peroxide by electrolysis; (*d*) the construction of electrolytic converting tanks or troughs, in which both the electrodes are constituted by a number of sets of superposed trays (preferably of lead), containing the materials to be acted upon electrolytically.—J. T.

XIX.—PAPER, PASTEBOARD, Etc.

Gas-fired Digestor for use in the Manufacture of Paper Pulp from Wood, Straw, etc. T. A. Reid, Liverpool. Eng. Pat. 9774, July 5, 1884.

THIS invention relates to a gas-fired digestor arranged with a peculiar system of flues, whereby the digestor can be fired with safety, economy, and directly. For details of construction, drawings and method of preparing wood pulp by the alkaline soda process with this apparatus, see original specification.—H. A. R.

Process and Apparatus for the Manufacture of Cellulose and Glucose from Wood and other Vegetable Products. Adolph Behr, Coethen, Germany. Eng. Pat. 9797, July 5, 1884.

HITHERTO cellulose has been prepared for technical purposes from wood by extracting all other substances from the wood by means of sodium hydrate. By the process described in above specification, the wood is treated by other reagents than sodium hydrate, and in such a way as to produce pure cellulose, and at the same time to convert into glucose as much as possible of the admixtures, consisting chiefly of carbohydrates. The wood shavings are dried by steam, then digested thoroughly with hot oil of turpentine or fusel oil, washed with steam, treated with dilute sulphuric acid, and again washed; the pure cellulose obtained may be either bleached at once, or dried and stored. The glucose and glucose-forming bodies are contained in the dilute sulphuric acid and in the condensed steam which was used for driving off the turpentine or fusel oil, and the glucose from these solutions is worked up by suitable means.
—A. J. K.

Manufacture of Artificial Ivory. L. P. Merriam, Homerton. Eng. Pat. 10,765, July 30, 1884.

THE object of this invention is to produce a grained effect similar to real ivory, by means of xylonite, pyroxyline, celluloid or other equivalent material. The materials are reduced to sheets of different colours or shades, and placed in the machine known to xylonite-makers as a stuffing machine—*i.e.*, a cylinder and piston arrangement worked by hydraulic pressure or otherwise,—the machine being heated by steam to soften the material under operation. From this machine the material issues in rods or strips, which are again compacted into solid blocks by pressure. It is claimed that imitation ivory made by this process is more like the genuine article than that made in the ordinary way.—H. A. R.

Improvements in the Preparation of Safety Papers for Cheques, etc. J. Jameson, Newcastle. Eng. Pat. 11,087, August 9, 1884.

THE object of this invention is the production of a safety paper, which shall indicate by a change in appearance any chemical or mechanical attempts at erasure or alteration. The inventor forms upon the paper a more or less intricate design, discoverable by reflected light, owing to a difference in the amount of glazing on the two surfaces. The design may be produced by pressure from plates or rollers, so as to slightly emboss the surfaces, or by extra application of size, forming thereby the said design, or else by the printing on of a soluble film. Another means is to highly glaze the whole surface first and then form the design by damp printing. The inventor may also use any convenient soluble chemical (*e.g.*, iodide of potassium), which by its reaction (*e.g.*, with mercuric chloride) will show whether the paper has been subjected to any sponging with a view to remove ink, such as what is known as "school-room ink," which contains no mordant.—H. A. R.

Utilisation of the Sodium Sulphide Liquors from the Manufacture of Cellulose. Oesterreichischer Verein für Chemische und Metallurgische Production. Ger. Pat. October 14, 1884.

THE waste liquors resulting from the preparation of cellulose by the sodium sulphide treatment, are worked up to black ash by evaporation and subsequent furnacing with lime and coal. Sodium sulphide lye is obtained by boiling this black ash in water, or even by heating the dilute waste liquors under a pressure of about three atmospheres.—W. D. B.

Improvements in the Treatment of Dry Absorbent Bodies for Manufacturing various Useful Materials. E. Paul Louvot, Paris. Eng. Pat. 2979, March 6, 1885.

Inventor brings into contact with coal-, wood-, or petroleum-tar, products composed of cellulose, such as cardboard, paper, rope, string, thread, stuffs, canvas, dry paper pulp, etc. The vessel containing the mixture is hermetically closed, and by creating a vacuum the tar is forced into the pores of the cellulose. Pressure is then applied to the material. After being moulded into sheets, the material is placed between stones, and freed from tar-oils by heat and pressure. The resulting substance is termed "corozine." It is impermeable, uninflammable, acid-proof, unputrefiable, and capable of numerous applications—viz., for impermeable roofing, "cuir bouilli" or papier-maché products, barrels and pipes for acids and gases, etc.—H. A. R.

Improvements in the Manufacture of Fire and Waterproof Boards or Paper from Asbestos. W. E. Heys, Manchester. From E. Ludewig, of Frankfort-a-O., Germany. Eng. Pat. 4151, April 2, 1885.

This invention relates to the manufacture of non-hygroscopic asbestos boards or papers. American or other soft fibrous asbestos, to the amount of 20-25% of the weight of the dry finished board, is taken and mixed with 25-35% of powdered aluminium sulphate. When well mixed the mass is impregnated with a 50% solution of zinc chloride in water. After washing with water, the mass is treated with ammonia, and after another washing with water, an addition is made of a 10% solution of resin soap, mixed with an equal amount of sulphate of alumina. To the pulp thus prepared in the rag-engine, inventor adds above 35% flour of ordinary or "green" asbestos stone. Finally, 5 to 8% of barium sulphate is added, and when diluted with water as required, the pulp may be employed for either machine- or hand-made paper. It is proposed to prepare a material suitable for roofing purposes, by covering on both sides ordinary tarred roofing paper or felt with asbestos paper prepared as above.—H. A. R.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

The Production and Use of Hydrogen Peroxide. W. Lindner. Chem. Zeit. **9**, 940 and 976.

The introduction into commerce of a peroxide of barium of 70 to 75 per cent. rendered it possible to prepare hydrogen peroxide for about one-quarter the cost of the English product, the purity and stability being equal. In 1878 experiments were made on the bleaching of lawn and ivory with encouraging results. The preparation of hydrogen peroxide is best effected by the old peroxide of barium method. The peroxide must be as pure as possible, very finely divided by sieving with a considerable quantity of water, and freed from barium hydrate by washing. The decomposition of the peroxide of barium may be effected by means of hydrofluoric, hydrofluosilicic or phosphoric acid, but best by one of the two latter. Oxalic acid gives a good yield, but the product is not stable. The introduction of the pasty peroxide of barium into the dilute acid must be very gradual, the temperature must not rise above 20° C., and the liquid must be maintained in constant agitation. When the neutralisation of the solution is sufficiently approximated the liquid is separated from the sediment—after adding a little phosphoric acid when the decomposition was effected by hydrofluosilicic acid,—and freed from dissolved baryta by the addition of a little sodium sulphate. The most stable peroxide of hydrogen is that which has been prepared with phosphoric acid, and contains a small proportion of that acid in the free state; the addition, however, of phosphate of soda to peroxide of hydrogen containing free acid, other than phosphoric, is found to increase the stability. The strength of a solution of peroxide of hydrogen is best determined by titration with solution of permanganate containing 7·9grm. $KMnO_4$ per litre. A convenient plan giving results within 0·1 per cent. in about three minutes is to take 2cc. of peroxide in a graduated tube holding 35cc., add five to six drops of hydrochloric acid, and then the standard permanganate solution, gradually, and with thorough agitation, until the contents of the tube are of a red or brownish colour; the quantity of solution added is now read off, 5cc. representing 1·0 per cent. of H_2O_2. When really stable, hydrogen peroxide can be stored in pitched barrels, tin cans, either varnished with amber varnish or plain, as well as in glass bottles; and it has been found that, avoiding high temperatures and the action of light, the deterioration on storing for three months does not amount to so much as 0·1 per cent. For the bleaching of ivory and other compact materials, it is only necessary to immerse the pieces in the acid solution till sufficiently white, the tint being observed in a sample after drying. For bleaching fibrous substances such as hair, it is advisable either to employ an ammoniacal solution of the peroxide, or else first immerse the material in the usual acid solution, allow the excess of liquid to drain away, and place the thus moistened substance in an ammoniacal atmosphere; this latter plan is specially applicable to Tussah silk, which must not lose its lustre. The employment of hydrogen peroxide as a discharge in printing is recommended by Schmid. For household purposes the peroxide may be safely used to remove from white goods stains of ink, wine, fruit juice, and the like, the best plan being to moisten the spots with the peroxide and add a few drops of ammonium chloride solution. Ornaments of bone and ivory yellow with age are readily whitened in a few days; fabrics yellow with age are also readily and safely restored with the peroxide. Péan and Baldy recommend the peroxide for the disinfection of wounds, Pommer and Ebell for the regulation of the fermentation of beer, wine, must, and worts; Krandauer, however, believes that a foreign taste is thus imparted to the liquor.—W. D. B.

On Narceine. A. Claus. Ber. **18**, 1569.

Narceine-ethylbromide $C_{23}H_{29}NO_9.C_2H_5-Br$ is obtained by heating narceine with a slight excess of ethylbromide with back-flow condenser, or in a closed tube in the steam-bath.

Narceine-ethylchloride is obtained from the corresponding bromide by decomposition with silver chloride. It forms well-characterised platinum and mercury double chlorides.

Narceine-ethylnitrate and oxalate can likewise be prepared from the bromide by double decomposition with the analogous silver salts.

Narceine-methyliodide, chloride and nitrate are prepared similarly to the ethyl derivatives. The platinum double salt of the methyl-chloride separates out as a crystalline powder, by treating an aqueous solution of the iodide with HCl. It is slightly soluble in water.

By boiling the above haloid derivatives of narceine with alkali, hydracid is formed, and a tertiary base is produced with the alcohol radical. In this way methylnarceine $C_{23}H_{28}(CH_3)NO_9$ has been prepared from narceine-methyliodide. The bases obtained in this way dissolve in dilute acids, and are reprecipitated with an alkali. They differ in this way from the quaternary ammonium bases—*e.g.*, narceine-methylhydroxyd, the salts of which are not decomposed with ammonia. Benzylnarceine has been obtained from narceine-benzylchloride by boiling with potash solution.

By the oxidation of narceine with potassium permanganate a new base of the formula $C_{17}H_{25}NO_{10}$ has been prepared.—J. B. C.

Papaverine. A. Claus and E. Hüetlin. Ber. **18**, 1576.

To prepare the haloid alcohol radical additional products of papaverine, the best method is to heat the substances together in a closed tube on the water-bath. The compound of ethylbromide and papaverine is readily obtained in this way; whereas, those with methyl- and ethyl-iodide and benzyl-chloride require heating 18-20 hours. The authors have prepared papaverine-methyl and -ethyl-iodide ethyl-bromide, chloride, and nitrate and benzyl-chloride of the general formula, $C_{21}H_{21}NO_4.RX$.

—J. B. C.

Benzoyl-ecgonine. W. Merck. Ber. **18**, 1594.

A crystalline by-product in the preparation of cocaine was heated with concentrated HCl in a closed tube to 100°. The acid liquid was poured off from the crystalline product formed, and both portions separately tested. The crystalline portion was found to be benzoic acid, the acid liquid on shaking out with ether gave a crystalline substance, from which, on treating with moist silver oxide, a base separated having the characteristic properties of ecgonine. The analysis of the original substance and its products of decomposition indicate the following constitutional formula :—$C_9H_{14}NO_3 - C_7H_5.O$.

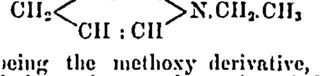
—J. B. C.

The Constitution of Cocaine. G. Calmels and E. Gossin. Compt. Rend. **100**, 1143-46.

The authors obtain by decomposition of cocaine hydrochloride with crystallised bariumhydrate and water at a temperature of 120°, the same products, which Lossen (*Ann.* 133, 351) prepared—viz., methyl-alcohol, benzoic acid and a crystalline substance (A) which, with HCl, yields benzoic acid and ecgonine. From the latter, by heating or evaporating the solution of its platinum double salt, the modified salt $(C_9H_{15}NO_3)_2PtCl_7$ is formed easily soluble in water. The alkali compounds of ecgonine crystallise with difficulty, and are decomposed with CO_2. The barium salt has the formula—

$$(C_9H_{14}NO_3)_2Ba+NH_2O.$$

The compound (A) gives, on distillation, an oil which passes over mostly at 210-230°, a crystalline hydrochloride and an orange platinum double salt. It is an isotropine which decomposes on distillation with baryta into ethylamine, and an oil free from nitrogen (similar to tropine, which yields methylamine). These compounds are derived from ethyltetrahydropyridine—



$$CH_2\left<\begin{matrix}CH_2.CH_2\\CH:CH\end{matrix}\right>N.CH_2.CH_3$$

isotropine being the methoxy derivative, ecgonine a carboxylated isotropine, and cocaine $C_{17}H_{21}NO_4$ the benzoyl-methyl ether of ecgonine.—J. B. C.

XXI.—EXPLOSIVES, MATCHES, Etc.

Progress in the Manufacture, Application and Knowledge of Explosives. Dingl. Polyt. J. **256**, 408.

Some experiments with "kinetite," a gelatinous mixture prepared according to Petry and Fallenstein's patent* (Ger. Pat. 31,786, June 18, 1884), are recorded in the Berg- und Hutten-Männischen Zeitung, 1885, p. 65. As compared both with gunpowder and dynamite, the results were very unfavourable; moreover, kinetite labours under the disadvantage of requiring a very powerful initial detonation.

Favier (Ger. Pat. 31,411, May 27, 1884) proposes to prepare a non-hygroscopic powder by mixing paraffin, resin or nitronaphthalene with hygroscopic nitrates, such as those of soda and ammonia. Apart from the somewhat uncertain degree of security against absorption of moisture thus attained, this composition labours under the great disadvantage of requiring an initial detonation provided by about 20 per cent. of gun-cotton or dynamite placed in the perforation of the compressed cartridge.

In the Transactions of the Technical Society of the Pacific Coast, 1884, i. 5, Jenssen discusses the causes of accidents in the manufacture of highly-explosive substances.

In consequence of certain representations which have been made in reference to the fraudulent conveyance of powder and sporting ammunition, a series of experiments has been carried out by the French Committee on Explosive Substances, to determine how far the conveyance of ammunition is to be considered attended with danger. The report of the committee is published in *Bulletin d'Encouragement*, 1885, vol. xii. p. 26. The committee arrived at the conclusions that with the varieties of ammunition mentioned below there was complete security against the detonation *en masse* of a package being caused by the explosion of one of its contents: Caps in tin-plate boxes, charged with 65 per cent. silver fulminate, 35 per cent. potassium nitrate; caps loaded with Gaupillat's mixture, packed in paste-board boxes; Flobert's caps containing 2 parts silver fulminate, 1 part of potassium nitrate, 1 part of sulphide of antimony, in tin boxes; caps for central fire cartridges in paste-board boxes; Gaupillat's cartridges of small calibre in paste-board boxes; revolver cartridges of both systems, sporting cartridges, and metallic rifle cartridges of all kinds. Flobert's and revolver cartridges may safely be sent express in boxes of not more than 5kilos., caps in boxes of not more than 2·5kilos. gross weight. The committee is also of opinion that detonators should not be regarded as safety ammunition.

Experiments carried out by Berthelot and others, as to velocity with which the detonation of various explosives is propagated, are recorded in the *Revue Industrielle*, 1885, p. 188. The explosives were contained in thin metal tubes of from 1 to 2mm. internal diameter, and from 100 to 200mm. long. The determinations were made partly with the aid of Sébert's and Le Boulengé's chronographs and partly with Sébert's velocimeter. The velocity of propagation was found to increase with the diameter of the charge, with the density of the explosive, and to be influenced by the composition, but not by the shape of the tubes. In tubes of 3mm. diameter nitroglycerine refused to detonate at 12°, detonated only partially at 14°, and required to attain to a temperature of 18° before it could be completely exploded under these circumstances. The following numbers give in meters per second the mean velocities of propagation of detonation of different explosives :—

Compressed gun-cotton in lead tubes 5200, in tin tubes, 5916. Granulated gun-cotton, 4770. Starch powder, 4885. Nitromannite, 6008. Nitroglycerine, 1078. No. 1 dynamite from Vonges, 2668. Panclastite, 4685. The velocity is less at the commencement than later on, and it was found that, measured at intervals of 25 meters, the velocity of propagation in compressed gun-cotton varied in a length of 100m. from 4661 to 5080m. per second.—W. D. B.

Improvements in Presses or Apparatus for the Manufacture of Compressed Gunpowder. H. H. Lake, London. From H. Gruson. Eng. Pat. 7108, May 1, 1884.

The improved form of press which is here patented differs from presses heretofore constructed, in that the table containing the matrices moves with the lower set of plungers, the upper set of plungers being motionless.

—W. D. B.

An Improved Explosive Compound. Thomas Wilkins, Peckham. From T. Petry and O. Fallenstein. Eng. Pat. 10,986, August 6, 1884.

A gelatinous mass is obtained by dissolving gun-cotton in nitro-benzene or other nitro compound of the aromatic group of coal-tar derivatives, and finely-powdered chlorate or nitrate of potassium or other base, together with sulphur, free or combined as sulphide, added to the jelly. The powdered salts are first well mixed and kneaded with the jelly till a homogeneous mass is obtained.

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* See Abstract, second column of this page.

The sulphur or sulphide is then introduced, and the whole well worked up. The best proportions are:

16 to 21 of the aromatic nitro compound.
¾ ,, 1 of gun-cotton or other form of nitro-cellulose.
82¼ ,, 75 of chlorates and nitrates.
1 ,, 3 of sulphur or sulphide.

The resultant explosive is of a plastic nature, and may readily be formed into cartridges.—W. D. B.

Improvements in the Manufacture of Explosives. C. W. Curtis, London. Eng. Pat. 15,647, November 27, 1884.

THIS invention has reference to the preparation and use in the manufacture of gunpowder, of charcoal rich in hydrogen and comparatively poor in carbon, derived from cocoa-nut fibre and other fibrous substances. Such charcoal, in which the hydrogen bears to the carbon a proportion of one to ten or one to eleven, is obtained by slowly charring or roasting, for from four to six hours, the fibrous material in the usual apparatus consisting of a cylinder revolving within a retort heated to a dull or dark-red heat. Charcoal so prepared is of a rich dark-red colour. The proportions of the ingredients of powder into which this charcoal enters, are preferably 1 of sulphur, 25 of potassium nitrate, and 5½ of the charcoal. —W. D. B.

XXII.—GENERAL ANALYTICAL CHEMISTRY.

Analytical Notes. C. de la Harpe. Bull. Mulhouse, 1885, 245.

(*a*) THE normal sulphates of the alkali metals are decomposed on heating them with halogen hydracids. Thus: 2·18grm. K_2SO_4 were heated in a water-bath with HCl, and the residue dried at 120-140°, till the weight was constant; it then weighed 2·61grm., showing that conversion into acid sulphate had taken place, according to the equation $K_2SO_4 + HCl = KCl + KHSO_4$. Titration of the residue showed that the quantity of acid sulphate obtained was ninety per cent. of the theoretical. With sulphate of soda seventy-seven per cent. underwent conversion. With potassium sulphate and hydrobromic acid, the corresponding decomposition approaches completeness, ninety-five per cent. and ninety-nine per cent. being realised in two experiments, the residue being dried at 140°. The reversal of the decomposition takes place at temperatures varying with the several hydracids; thus, in the case of hydrofluoric acid, when the residue was dried at 110°, it contained eighty per cent. of the potassium sulphate as hydrosulphate; dried at 140°, on the other hand, only forty to forty-five per cent. With nitric acid and potassium sulphate the decomposition reached eighty-two per cent., the residue being dried at 140°. Formic and acetic acids were found to be entirely without action. (*b*) To determine the acidity of solutions which cannot, from whatever cause, be directly titrated with alkali, the author distils from sodium acetate, added to the solution in sufficient quantity. The distillation is effected under diminished pressure, whereby it may be carried nearly to dryness, without allowing the temperature to exceed 120°, and the whole of the acid—*i.e.*, the equivalent of acetic acid—obtained in the one distillate. This process is not applicable to solutions containing salts, which are dissociated on boiling—*e.g.*, salts of iron, aluminium and chromium. (*c*) In determinations of the alkaline earth metals in solutions containing ammonium sulphydrate, the author points out that the usual preliminary of acidification with hydrochloric acid and boiling is attended with the danger of the formation of sulphuric acid, and consequent precipitation of the metals. (*d*) The precipitation of tin and arsenic, as sulphides, from solutions of stannates and arseniates, is much expedited by heating with ammonium sulphydrate, in presence of ammonia in excess, at 80-90°. Hydrochloric acid is then added in quantity sufficient to decompose the sulphydrate, and the metals are completely precipitated as sulphides. (*e*) In preparing dithionic acid by the oxidation of sulphuric acid, the author recommends the employment of the manganic oxide in the hydrated form. The gas is passed into water at 0°, and the oxide added from time to time in the form of paste, taking care to keep the sulphurous acid in excess. (*f*) The author describes a triangle for supporting crucibles, the dimensions of which may be varied at pleasure, consisting of three wires, which may be made to include any angles by insertion into holes pierced in series, in a suitable ring, at corresponding segments. Such a triangle will be found especially economical in the case of platinum wire. (*g*) The ordinary method of carrying out Bunsen's process of indirectly estimating elements and radicles which may be made to liberate iodine from potassium iodide, has the defect of being difficult of control. The author describes a simple apparatus whereby the distillation may be conducted in a stream of carbonic acid gas, and the process thereby brought within the complete control of the operator. The author recommends the process for the estimation of nitrates. He is investigating its adaptation to the indirect determination of sulphurous acid and other reducing agents.—C. F. C.

Determination of Strength of Permanganate Solutions. G. Krüss. Ber. **18**, 1580.

TO avoid the usually tedious process for determining strength of solutions of liquids possessing a characteristic absorption spectrum, the author proposes to utilise this property for such determinations, as being more rapid and equally reliable. Quantitative spectrum analysis gives us a method for determining the coefficient of extinction (E) in certain regions of the spectrum of a solution, of which the relative absorption power for light (A) is known. The concentration (C) of the solution can be determined for E.A = C. Potassium permanganate was prepared pure, according to Gregory's method, and the extinction coefficient determined for different strengths of solution by the method of Vierordt. The observed results agree well with the ordinary volumetric determination with standard sodium hyposulphate solution. For further details and table of observations, the original paper should be consulted.—J. B. C.

Dimethylamidoazobenzene as an Indicator in Alkalimetry. B. Fischer and C. Philipp. Chem. Zeit. **56**, 998.

THE end reaction is marked by a change of colour, from yellow to pink. The indicator is prepared by dissolving 9·3 parts aniline in 30 parts 25 per cent. hydrochloric acid, diluting with water, and then adding an aqueous solution of 7 parts sodium nitrite to the cooled liquid. The solution is then poured into one containing 12 parts dimethylaniline dissolved in 15 parts 25 per cent. hydrochloric acid; finally about 30 parts sodium acetate are added until the solution smells of acetic acid. Crystals separate out which can be purified by crystallisation from alcohol. It is neutral towards free carbonic acid. —S. R.

Gravimetric Determination of Manganese. H. v. Jüptner. Chem. Zeit. **9**, 692.

FOR the determination of manganese in iron and steel, also in iron ores and slags, the following method is adopted. The HCl solution of the substance to be tested (in which any ferrous salt must be previously oxidised with $KClO_3$) is neutralised with Na_2CO_3 in a graduated flask, NH_4Cl solution added, precipitated cold with $BaCO_3$, and after adding an excess of ammonia digested for some time by agitation. It is then filled to the mark, well mixed and filtered through a dry filter. An aliquot part of this filtrate is treated with H_2SO_4 to precipitate the barium present, and neutralised with ammonia with or without previous filtration; heated to boiling and precipitated with $(NH_4)_2S$. It is then filtered through a small filter and washed with $(NH_4)_2S$ water. If the precipitate is small it may be treated directly with boiling acetic acid, and to limit the amount of liquid the funnel should be furnished with a glass tap; with larger quantities, the precipitate is washed with acetic acid through the filter into a beaker. The acetic acid solution is filtered off into a weighed platinum basin evaporated to dryness, heated and weighed as Mn_3O_4.—J. B. C.

Apparatus for Fractional Distillation. F. Anderlini. Chem. Zeit. **9**, 941.

This apparatus consists of a worm of five or more convolutions, according to the number of which, four or more upright tubes corresponding with the connecting tubes in Bel and Heninger's apparatus, connect each coil of the worm with that next but one below it. The diameter of these connecting tubes is somewhat contracted at the bend which they take before entering the lower coil. These connecting or draining tubes serve to prevent an accumulation of liquid in the worm, and thus obviate any risk of a quantity of liquid being ejected into the condenser, should a sudden evolution of vapour take place.—W. D. B.

Examination of the Ash of Vulcanised Caoutchouc. C. Reinhardt. Stahl und Eisen, 1884, p. 649.

For the estimation of the ash in vulcanised caoutchouc, from 0·5 to 1grm. of the sample is cautiously heated in a covered crucible until the evolution of gas has ceased, and then in the open crucible until the organic matters are burnt off. The stronger the heating the less accurate are the results, since calcium carbonate loses CO_2. Gypsum is converted into calcium sulphide, and oxide of zinc transformed into sulphide or reduced and the metal volatilised. For the accurate estimation of the mineral constituents, sulphur excepted, from 0·5 to 1grm. of the caoutchouc in shavings is warmed in a beaker upon the water-bath with nitric acid of 1·4 sp. gr., until solution is effected. After cooling somewhat the solution is transferred to a porcelain basin, evaporated upon the water-bath to dryness, moistened with hydrochloric acid, and dissolved in water. Silicic acid and barium sulphate remain undissolved. The solution contains oxide of zinc, lime, magnesia, ferric oxide, and alumina, which are separated in the usual manner. The total sulphur is estimated by warming about 1grm. of the sample with 20cc. of nitric acid, potassium chlorate being thrown in from time to time. The solution is evaporated, dissolved in hydrochloric acid and water, filtered, and the sulphuric acid estimated in the filtrate and also in the barium sulphate, forming a part of the insoluble residue. The sulphur added to effect the vulcanisation is estimated by burning a portion in a current of oxygen at a low temperature and passing the gases of combustion into hydrochloric acid containing bromine; or the caoutchouc may be heated in a glass tube closed by fusion, and the sulphur estimated in the distillate.
—W. D. B.

Estimation of Fat in Palm-nut Meal and other Palm-nut Preparations. V. v. Wilan. Bied. Centr. **14**, 140-141.

When treating palm-nut meal in the ordinary way for fat determination in Soxhlet's apparatus for the usual time, 3 to 4 hours, low results are obtained, owing to the dense nature of the cake, and a subsequent extraction for from 5 to 6 hours yield another 1 per cent. of fat. Other feeding materials yield up their fat to within a very minute quantity during the four hours' extraction. This peculiarity of palm-nut preparations is attributed to the mechanical retention of fat which is closely pent up in the cells; and can, therefore, only be attacked by the ether with great difficulty, and only after some time comes into solution. The results of experiments with this material ground to different degrees of fineness confirm this view, for coarse samples retained considerable quantities of fat, whereas finely-pulverised samples yielded up all their fat in the 3 to 4 hours.—D. A. L.

Improvements in Sampling and Testing Apparatus for Spirituous Liquors or other Liquids. J. O'Neil Mackle, Liverpool. Eng. Pat. 12,585, September 19, 1884.

This improvement consists essentially of a glass cylinder fitted with a valve at bottom opening inwards, acting automatically or by hand, so that an average sample or a sample at any required depth may be taken from a cask or vessel containing the liquid. The cylinder carries inside a hydrometer, inside which is a thermometer, the means for ascertaining the specific gravity and the temperature of the sample being thus comprised in the sampling instrument.—G. H. B.

An Improved Method of and Apparatus for the Quantitative Estimation of Hæmoglobin in the Blood. A. M. Clark, Middlesex. From Dr. E. Fleischl, Vienna. Eng. Pat. 5991, May 15, 1885.

The method consists in comparing the depth of colour of a solution of the blood in water with a standard made of ruby glass ground into a wedge-shape and fixed in a form of chlorimeter, which admits of the thickness of the wedge at any point being read off on a scale. In order to provide the same tone of colour being transmitted through the ruby glass and the blood, the yellow light of a lamp or candle is used for the illuminant—G. H. B.

Test for Chloralhydrate. M. Hirschfeld. Archiv d. Pharm. 1885, **223**, 26.

By adding to a solution of chloralhydrate a small quantity of calcium hydrosulphide, a red colouration ensues after the lapse of about half-a-minute. A fainter but still clearly perceptible reaction takes place when a solution of sulphuretted hydrogen and lime water are added to a chloralhydrate solution.—F. M.

A New Reagent for Aromatic Orthodiamines. O. Hinsberg. Ber. **18**, 1228.

For the detection of small quantities of *m*-*p*-toluylenediamine and *o*-phenylenediamine the author found phenanthrene-quinone a very suitable reagent. The reaction depends upon the formation of diphenylene quinoxalines, which are only slightly soluble. An alcoholic solution of the diamine to be tested is boiled for a short time with a solution of phenanthrene-quinone in glacial acetic acid. If an orthodiamine be present, a bulky precipitate, consisting of fine yellow needles, is formed while the liquor is still boiling. On separating it by filtration and moistening it with hydrochloric acid it turns deep-red. The paradiamines form a similar compound with phenanthrene quinone, but it is not acted upon by hydrochloric acid. The author thinks that this reaction may probably be generally suited for the detection of aromatic orthodiamines.—S. H.

New Books.

Alkali, etc., Works Regulation Act, 1881. Twenty-first Annual Report on Alkali, etc., Works. By the Chief Inspector. Proceedings during the Year 1884. London: Printed by Eyre & Spottiswoode, East Harding Street, Fleet Street. 1885. Price 6d.

This Government Blue Book, just recently issued, contains the Chief Inspector's Annual Report to the Local Government Board for the year 1884. It contains in all 91 pages of matter, preceded by a table of contents arranged as follows:—Introduction; Alteration of Districts; Arrangement of Districts; Location of Inspectors; Wool Carbonising Works; Venetian Red Works; Manure Works; Deposit of Alkali Waste; Bleaching Powder Chambers; Apparatus for Testing the Air of the Chambers; Proposed Rule for Bleaching Powder Makers; Provisional Orders; Prosecution under the Act; Inspectors' Reports—the districts reported being numbered and named as follows:—District No. 1. Scotland and Ireland; No. 2. North; No. 3. Cheshire, North